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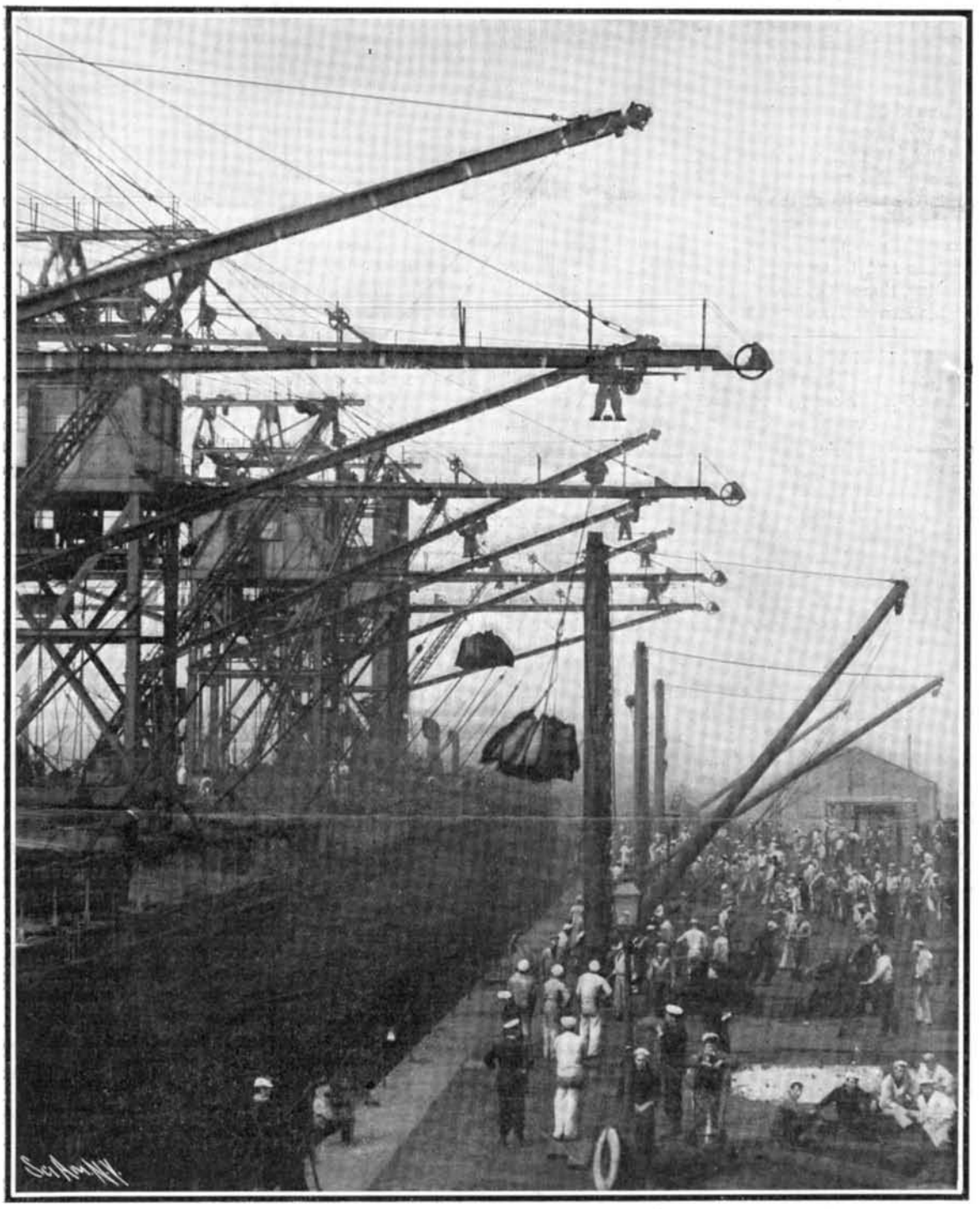
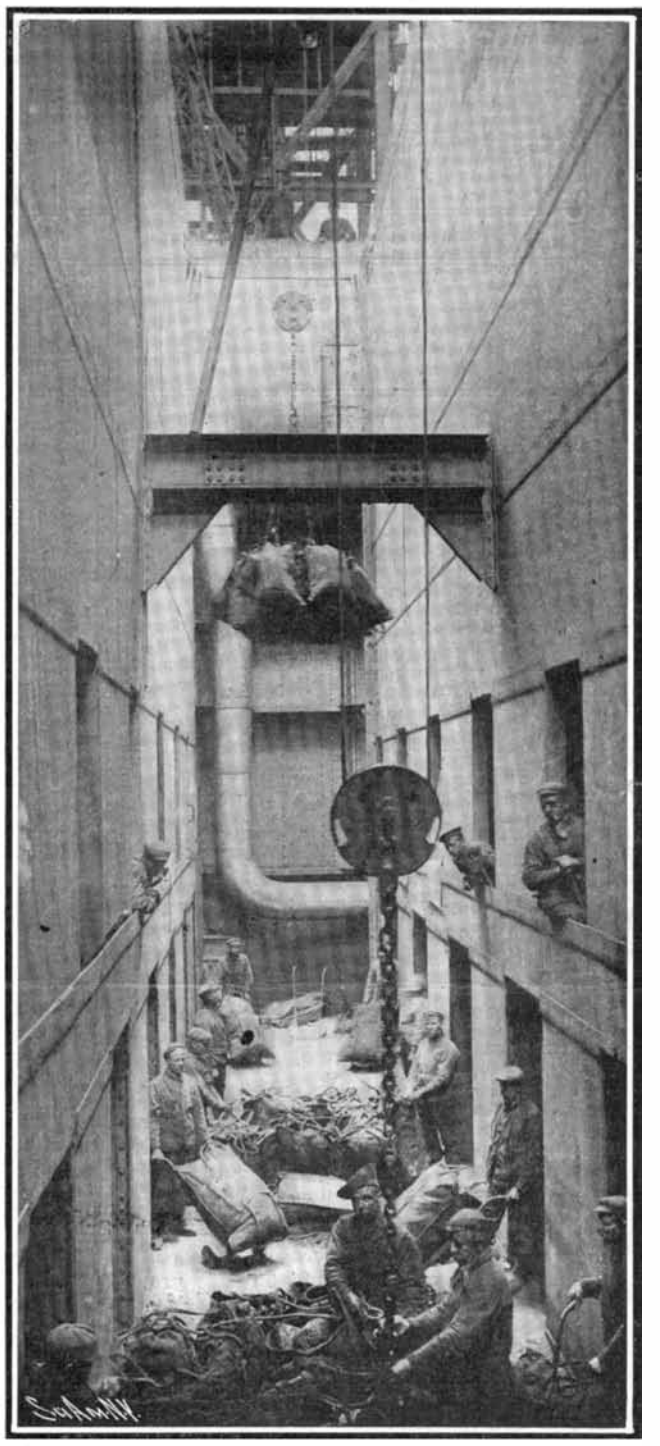
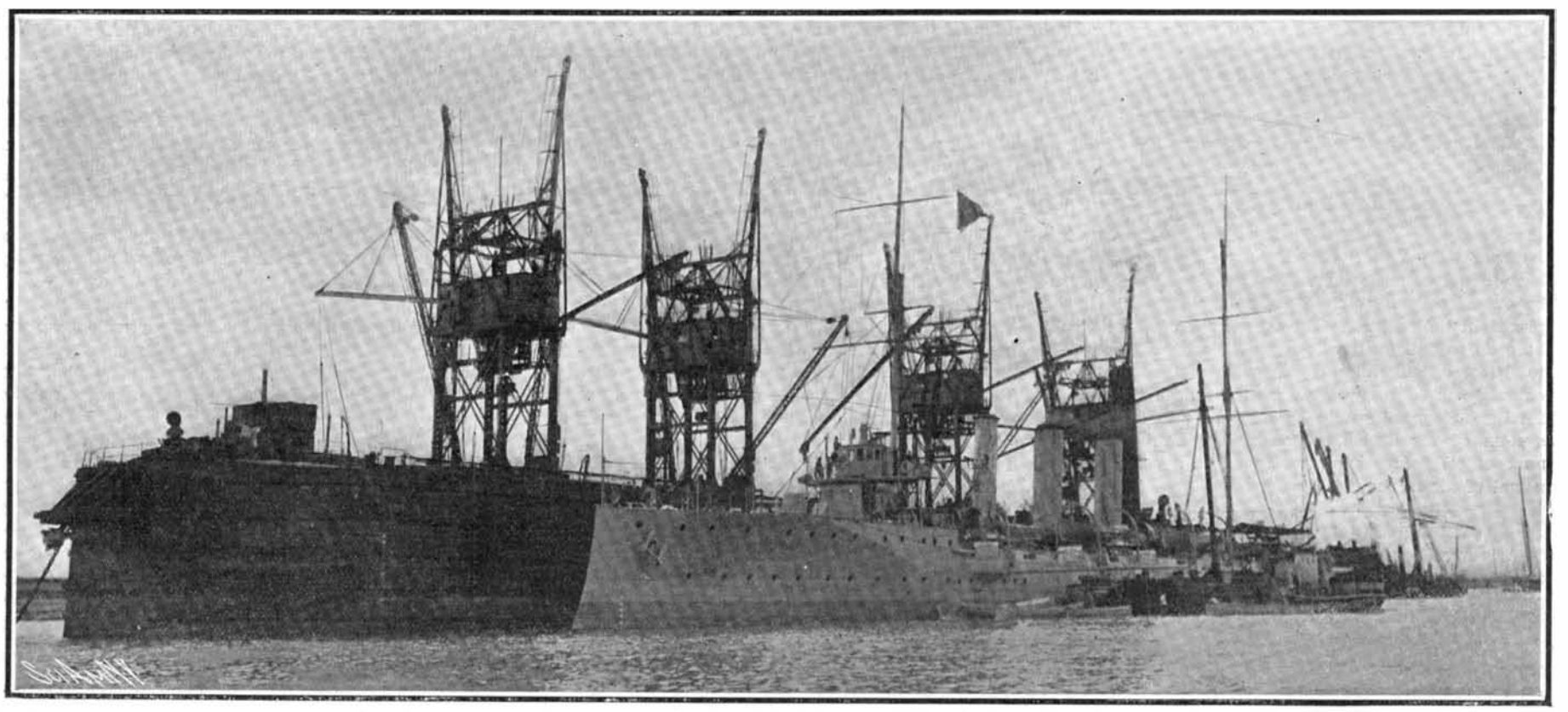


Transferring the Coal to a Supposed Warship with the Assistance of 770 Sailors.

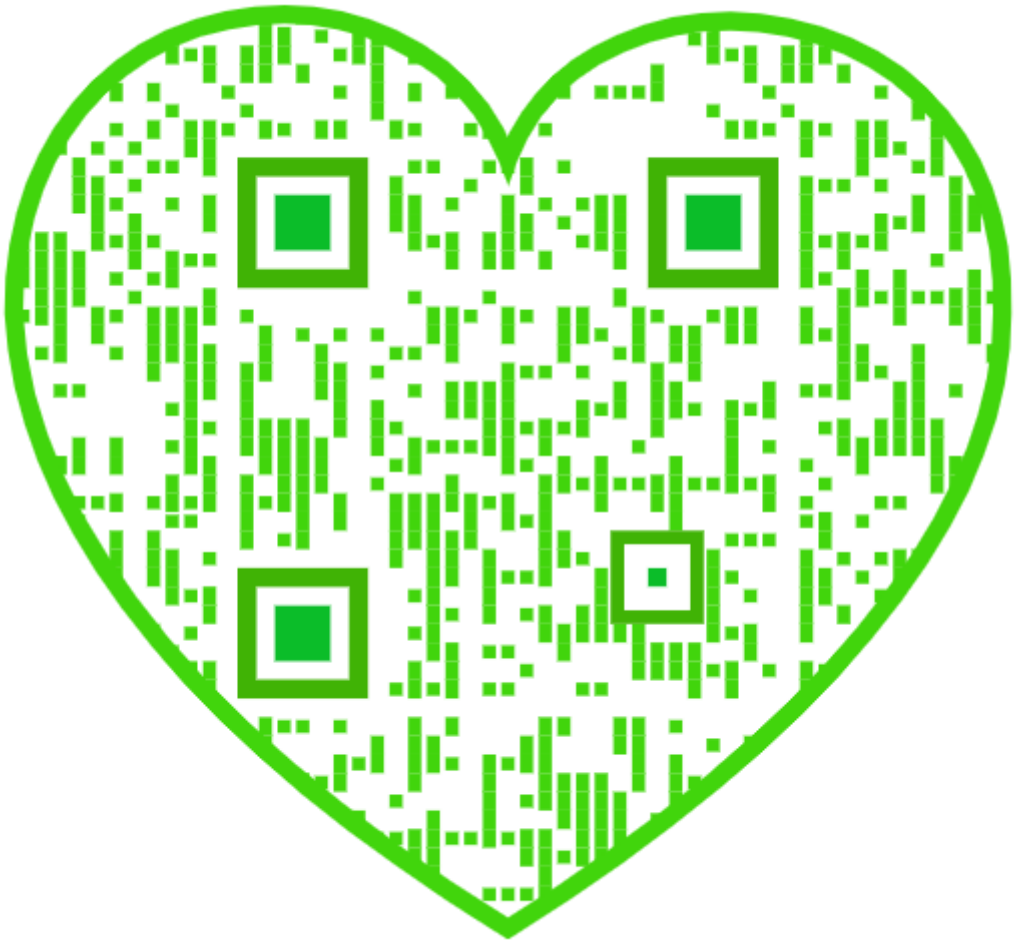


Hauling up the Coal from the Bunkers.



Coaling a Cruiser from the Floating Coal Depot.

FLOATING DEPOT FOR COALING WARSHIPS.—[See page 68.]



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NEW YORK, SATURDAY, JANUARY 20, 1906.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

PIPE GALLERIES IN THE NEW SUBWAY.

Now that rapid transit subways in this city have acquired all the prestige which comes from twelve months of remarkably successful operation, it is to be hoped that the Rapid Transit Commission will be emboldened to take an unyielding stand on the important question of the construction of pipe galleries. It is a most regrettable fact that the present subways have been built without any pipe galleries, and that the various gas and water mains lie spread out over the roof of the Subway, under conditions which will mean the ripping up of the streets whenever a break occurs, or a new system of pipes has to be laid down. In justice to the Rapid Transit engineers, it should be stated that originally they drew up complete plans for pipe galleries extending on each side of the Subway. The Rapid Transit Commission, moreover, approved of these plans, and was anxious to have them carried out. That they were not built was due to interference from the department which is responsible for the major part of the street mains. The grounds of this interference were apparently of the most trivial and unreasonable character; and there is no doubt that had the Rapid Transit Commission carried the question into the courts, they could have secured the necessary legal indorsement for the construction of the galleries. At that time, however, the Subway scheme was opposed by many powerful interests, and the Commission decided that rather than run the risk of legal delays, it would be better to forego the pipe-gallery plans for the time being, and push the Subway itself through to completion.

To-day, however, the Rapid Transit proposition in New York city needs no such delicate handling. It has established itself as one of the most attractive ventures for the investment of capital. It is safe to say that the very interests which did their utmost to kill the Rapid Transit scheme when it was advocated on the high grounds of public utility, are now falling over each other to secure Rapid Transit franchises, because of their proved commercial value. It is not likely that there will be any opposition to the construction of pipe galleries as a part of future extensions of the Subway. The objections that were raised against them originally were altogether trivial, and were strongly suspected of being prompted more by political considerations than they were by considerations of a constructional or operative character. The only plausible objection on technical grounds was that offered by the gas companies, namely, that the presence of electric mains and gas mains in the same galleries might, under certain conceivable conditions, lead to serious explosions. We consider this danger to be exceedingly remote. The gas mains would be so placed in the galleries that every part of them would be open to daily inspection; and it would be possible to detect a leak long before sufficient gas could accumulate to form explosive mixtures with the air. A further safeguard would be afforded by utilizing the system of ventilation, which should be installed as part of all future subways, to effect a continual renewal of air in the galleries.

WE SHOULD USE THE METRIC SYSTEM.

It is gratifying to note that the agitation for the introduction of the metric system of measurement is growing in strength, and seems not unlikely to be pushed to a successful issue. Judging the question from the purely practical standpoint, and in a broad-minded spirit, there is everything to be said in favor of, and nothing against, this most rational and convenient system. It is really surprising that a nation which is as eminently practical as we are, and which has proved by over a century of use that as a system of coinage and for all monetary transactions, the metrical is ideally perfect, should for so many generations have been content to subject its arts and industries to the burdensome inconvenience of the old system of measurement.

At the same time, it would be a mistake for the advocates of the metric system to shut their eyes to the fact that its introduction could not be brought about without incurring in some quarters a certain amount of inconvenience and some pecuniary loss. To those whose hostility is based upon the fact that their interest would, for the time being, be temporarily affected, the argument should be presented on the high ground, that great improvements of a broad and sweeping character have usually been attended with a certain amount of inconvenience to the small minority. This minority must take such comfort as it can from the reflection that its temporary loss or inconvenience is absolutely insignificant compared with the vast national benefit that would be conferred, not merely in the present hour, but for all time. The question of the relative merits of the decimal and duodecimal systems has been well threshed out, and we believe there is practically a universal agreement that, except for the minor and temporary drawbacks attending its introduction, there is everything to be said in favor of the more modern and rational method.

ALTERNATIVE SCHEMES FOR THE PANAMA CANAL.

The average citizen of the United States may well be excused if the subject of the Panama Canal appears to him to be just now something of a Chinese puzzle. What with reports of committees and advisory boards, plans for high-level canals and plans for low-level canals, plans for canals with locks and plans for canals without, to say nothing of the 500-foot "Straits of Panama," it is certainly difficult for the average workaday citizen to distinguish fact from fiction, and find in the flood of printer's ink with which the subject has been deluged a few solid verities, on which he may plant his feet and say, "This at least I know to be true."

Broadly speaking, there are, at the present writing, three leading proposals for the construction of a canal across the Isthmus, and with these three we propose to deal in separate articles in the SCIENTIFIC AMERICAN. The first is that proposed by the former Chief Engineer of the Panama Canal when it was under French control, Mr. Bunau-Varilla. It contemplates the early completion of a high-level canal, and its subsequent widening and deepening after it has been opened to navigation. The second proposal is that of a leading American hydraulic engineer, Mr. Lindon W. Bates, who proposes the formation of a large fresh-water lake at each end of the canal, and the creation of a central lake by means of a dam at Bohio; the surface of this lake to constitute the summit level, which would be cut through the Culebra divide at an elevation of about 60 feet, the level of the two terminal lakes being held at about 30 feet. The third proposal is that which it is understood has been agreed upon by the International Advisory Board of Engineers, and which recommends the immediate construction of a sea-level canal provided with a tidal lock near its Pacific terminus.

The first type of canal, to which its author has given the high-sounding title "Straits of Panama," forms the subject of illustration and description in the present issue. In an early succeeding issue we shall give an illustrated description of the Lindon W. Bates lake-and-lock project; to be followed in due course by a third article on the proposal of the President's Advisory Board, the full report of which will be available at an early date.

In presenting the Bunau-Varilla and Bates proposals we offer no words of criticism one way or the other, and this for the reason that both plans will be the subject of comment in the forthcoming report of the Advisory Board to the President of the United States. The high position held by Mr. Bunau-Varilla during the operations of the French company and the wide experience and well-deserved reputation of Mr. Bates in operations involving the excavation and removal of material in works of the general character of the Panama Canal, demand for both of these engineers a thoughtful hearing. Although the plans of Bunau-Varilla for digging out 600 million cubic yards of material, and dumping it all into an artificial lake that is 200 feet above tide level, are calculated at the first hearing to stagger the conservative mind of the average engineer, it must be remembered that its author has a wider acquaintance with the actual conditions of work on the Isthmus than any living engineer.

ELECTRO-TECHNICAL INDUSTRIES.

The complete revolutionizing of many old industries, and the creation of entirely new ones, by electricity in the last half dozen years represent some of the most marvelous achievements of the present century. In no line of scientific and experimental work are the uncertain opportunities for magnificent possibilities so brilliant as in the practical laboratory of the electrical engineer and chemist. Electricity supplied in large and cheap current permits the experimenters to make tests in the fusing of metals, which a dozen years ago could not be performed except at enormous cost in time and money.

Electro-metallurgy has given a tremendous impetus to the manufacture and refining of many common articles of commerce, and owing to the cheapening of their manufacture, the demand for them has enormously increased. Thus in the production of aluminium the price has been so reduced in the last few years that it is employed in many new industries. The most noticeable field of usefulness is the substitution of aluminium transmission wires for copper in the electrical industries. The new transmission lines are of stranded aluminium, and they carry heavy voltage over great distances. The longest transmission line in the world, from Electra to San Francisco, a distance of 154 miles, is composed of stranded aluminium wire, and also the Colgate to Oakland line, a distance of 144 miles. The demand for aluminium is so great, that all the electrical manufacturing companies engaged in its production are extending their plants to increase the output. There are to-day upward of 70,000 electrical horse-power used in the manufacturing of aluminium in this country and Europe. Four plants are located in this country and they have available for the manufacture of aluminium upward of 24,000 horse-power, and the total output of the American plants varies from 15,000 tons upward a year. With the development of the Niagara power the extension of these aluminium manufacturing companies is being rapidly pushed, and the total capacity of the plants is likely to double within a year or two.

In copper refining electricity has achieved results no less notable than in the production of aluminium. There are upward of thirty-two electrolytic copper refineries in operation to-day, and considerably over half the world's output of copper is refined in these plants. The annual output of electrolytic copper is estimated at nearly 320,000 tons a year. In spite of the cheapening of the refining of copper by electricity, the price has steadily advanced in recent years. The employment of electricity for the extraction of copper from low-grade ores has also developed a good deal, and in this new development it may be possible to materially increase the world's annual supply. In Canada the electrical extraction has been quite successful with ores containing only from 2 to 4 per cent copper. An experimental company of French operators have more recently located a plant in Chili to handle the low-grade native ores of that country by means of an electric furnace process of concentration. The recovery and refining of scrap copper has also assumed considerable proportions in this country. By means of the electrolytic process, old copper bottoms, boilers, tubing, nails, sheet clippings, and type-shells can be utilized in a remarkable way. Scrap copper of this nature commands from 12 to 13 cents a pound, and is only a trifle less than casting copper. The scrap copper is thus recovered at little cost, and used over again in the industries. Old copper wire commands a premium to-day at prices ranging from a cent to half a cent less than that of the best casting copper.

The manufacture of artificial graphite with the electric furnace has assumed considerable importance, and to-day upward of 3,000 horse-power is used in supplying the electric furnaces with heat for this purpose. The output of artificial graphite at Niagara Falls last year was over three million pounds. The method of production is covered by patents, but the process consists of converting a large mass of coke or carbon into graphite by means of the electric furnace. At a certain temperature all carbides decompose, and the carbon separates in the form of graphite, but by the process now used only a small amount of iron or silicon is required for the purpose. The flourishing nature of this industry has led to further extensive experiments with the electric furnace in the treatment of carbides.

The use of the electric furnace in the iron and steel industry has promised for several years great transformation of smelting, but the actual reduction or iron ore for steel making by means of the electric furnace has not yet attained a large commercial success. A number of such furnaces have been in operation in different parts of the country, and new improvements are constantly being made to simplify the process. In certain parts of the world where electric current is very cheap and abundant, iron ore plentiful, and coal scarce and high priced, the electric furnace may displace the ordinary blast furnace for the production of pig iron. Or what may be nearer the truth, the use of the electric furnace in certain regions near great hydraulic works may build up electric smelting where it would be impossible to succeed with coal as a fuel.

In the specialized field of making high-class steels and steel alloys from scrap, the electric furnace has a more promising outlook, and quite remarkable achieve-

ments have already been made. Both in Germany and France such electric furnaces for steel making have been in profitable use the past year. In France at Le Praz, in Savoy, a plant for steel making utilizes the Heroult furnace, in which the electric arc is employed for heating, and at a cost of 6.5 c. per ton for electrical energy between six and ten tons of specialized steel are produced daily at a good profit. Over 5,000 tons of steel have been produced at this plant. Two other plants are in successful operation in France, one of which uses the arc for heating and the other the resistance method. In Italy the Stessam electric furnace is employed extensively, and in Germany similar attempts at steel making by the electric method are being carried on with more or less success.

In this country and Canada the electric steel furnace is in operation experimentally. At Massena a new process in which a patented electric furnace is employed has been tried, and the project promises much for the future. At Niagara Falls the Ruthenberg process is also in use, but not commercially. A number of other plants, using either the Heroult or Keller furnace, have been established, but so far most of them are making tests for future commercial exploitation.

In the manufacture of such alloys of iron as ferro-chrome, ferro-silicon, and ferro-titanium by the electric furnace, a great commercial success has been attained. At Niagara Falls ferro-titanium is made in the electric furnace from scrap iron, aluminium, and cheap titaniferous iron ore. Even discarded slag is utilized. Likewise ferro-silicon is made from scrap iron and scrap steel. A good many of the old carbide works which failed have been rebuilt for manufacturing ferro-silicon. The resistance type of furnace is employed for this work, and the scrap iron or steel is melted at a high temperature with pure quartz. A 4,000-horse-power plant generally turns out about 20 tons of this alloy a day. Ferro-chrome is an alloy used in the manufacture of face-hardened steel, especially for armor plates and tools. One plant turns out upward of 1,800 tons per year for the Carnegie and Bethlehem steel companies. The electric furnace employed for this manufacture is not materially different from those used in allied industries. Ferro-manganese is made in the electric furnace for the steel industry on a smaller scale, but it has become an important factor in modern production of high-grade steels.

The question of using the electric furnace in glass manufacture has received unusual attention the past year, and it is predicted that a complete revolution may be thus created in this industry thereby. If the electric furnace should prove as successful as promised in this field, it would probably mean the shifting of the center of manufacturing from Pittsburg to Niagara Falls or some similar place where electric current can be had cheaply and in abundance. It is not likely for some time to come that the electric furnace can displace the regenerative gas furnace for glass making except in a few favored regions. However, in Germany electric glass furnaces are being used, especially in the production of quartz glass vessels for chemical purposes. The quartz-glass manufacture has assumed a good deal of popularity in many new lines of work, for the glass is not easily fractured by sudden changes of temperature, and its melting point is very high. In regions where quartz exists in great quantities, and water power for electrical development is favorable, the manufacture of quartz-glass vessels and articles in the electrical furnace appears to have a very promising future. Experiments are now being conducted by a number of companies along this line, and only the future can determine what ultimate effect the electric current will have upon the glass trade.

In bullion refining electricity has made great strides. Electrolytic methods of refining gold and silver are employed in all parts of the world. At Perth Amboy and Philadelphia large quantities of the two precious metals are thus refined. In Germany the electric refining of gold and silver is carried on even more extensively, and the combined outputs of the Frankfort and Hamburg refineries are valued at a good deal over ten million dollars a year. The electrolytic method of bullion refining, however, is increasing rapidly in this country, and as one of the largest producers of precious metals in the world, it seems not unlikely that we shall stand first in this industry of refining within a few years.

Electro-metallurgical industries include the manufacture of many other products of only slightly less importance than those mentioned. Such new products as silicon-copper and siloxicon are the results of the application of the electric furnace to experimental fields. Nickel, lead, tin, and zinc have all come under the power of electricity, and they are either refined or extracted from the ore by electrical methods in increasing quantity. Not the least important of these methods is the recovery of scrap. Scrap tin and zinc are recovered to-day by electrolytic processes, which make every tin can, tin roof, or tin boiler of potential value. Electricity has made phenomenal strides in saving the waste. Metal of any kind can be reconverted by it into useful material for new manufacture. In other words, the scrap heap and waste pile is as legitimate a field of exploitation for electricity as the mines with their rich or low-grade ores.

GEORGE E. WALSH.

SOME COSTLY EGGS.

BY ARTHUR H. J. KEANE.

By reason of the extinction of certain classes of birds, there are many eggs which are so scarce and costly, that they can be termed rarities without fear of exaggeration. The rarest of all the eggs of a still existent family of birds is that laid by the condor. At the present moment there is not in existence one single dozen perfect specimens, and the few there are can be seen solely in some of the wealthiest and richest collections. The condor, which is found in Southern California and the Andes, is now hopelessly doomed to die out. It is also practically impossible to collect any fresh specimens of its eggs, as these rare and extremely shy birds nest thousands of feet above the plains, in the most rugged and inaccessible fastnesses of the San Bernardino and San Jacinto Mountains. Hence finding and plundering (two very different things, by the bye) a condor's nest is regarded as a most wonderful and sensational event; in fact, a prize of $500 would not tempt any sane man to start out on the hunt for a fresh condor egg.

Still more costly are the eggs of the great auk, or garefowl, a flightless marine bird, with large head, heavy body, and compact plumage, the last two living specimens of which were discovered and killed in Iceland in the year 1844. One of these eggs is now to be seen, carefully preserved under a glass case, in the National Museum at Washington; the original owner sold it in London for £22 ($110) in the year 1851, whereas its present value is estimated at more than £2,000 ($10,000). In 1853 two other auks' eggs were sold in London for £85 ($425) apiece, while in 1869 a nobleman (Lord Caervagh) paid £74 ($370) for a damaged specimen. A Scotchman of the name of Powell was fortunate to buy two of these eggs in Edinburgh in 1879 for a mere song, viz., 32 shillings; a few weeks afterward he sold them for £240 ($1,200) each. In 1887 an auk's egg, which was sold for £40 ($200) in 1867, realized $800 in America. At the present time there are only from 70 to 80 specimens known to be still in existence; 12 of these are in the British Museum (London). This bird died out because of its inability to fly, and of the difficulty of its movements upon dry land. It used to nest in thousands on Funk Island (a rocky islet opposite the coast of Newfoundland) which at one time was used as a kind of provisioning station by whalers, who used to kill these fat and palatable birds in hundreds. The birds were knocked on the head with clubs, plucked (the feathers used to fetch a good price) and salted for future consumption.

Funk Island also used to afford shelter every year, at breeding time, to countless numbers of other natatory birds, among them being the white booby (*Sula bassana*). These birds have also met with the same fate as the auk. In the year 1860 their nests were still to be seen in thousands, but at the time of writing it would probably be a matter of impossibility to find one solitary specimen. Ruthless slaughter, and the scaring away of the birds—due to the erection of a signal station on the island, which used to fire off a shot every minute in foggy weather—soon led to a thinning of their ranks, and the price of their eggs already began to rise in the seventies. Now they are great rarities, and would fetch large sums, but unfortunately there are no specimens in the market. Some specimens are on view at the Smithsonian Institution and at the American Museum of Natural History in New York; they range in value from $500 to $750 apiece.

Large sums are also paid for the eggs of the aepyornis or moa, a gigantic wingless bird of from 12 to 14 feet in height, which as long ago as two hundred years was already dying out in Madagascar. In appearance the bird much resembled the ostrich, and its egg was one foot in length. The first specimen was brought to Europe (Paris) by a French merchant in 1851, and caused quite a sensation from the amount of interest it attracted; its cubic capacity is about equal to that of one hundred goose eggs. In 1897 one of these eggs was found swimming about on the southwest coast of the island of Madagascar, in Augustine Bay. It now lies in the British Museum, and is undoubtedly one of the most extraordinary and valuable relics of its kind.

The eggs of the aptornis, a recently extinct wingless bird, probably a member of the Rallidæ family, also fetch very high prices, fine colored specimens fetching as much as $750 to $1,000 apiece. The apteryx or New Zealand kiwi is a bird which, though still living, is becoming scarcer from day to day, and its final extinction is only a question of years. These kiwi breed very slowly, only one or two very large eggs being laid during the season, and as yet there is no record of the successful rearing of young in captivity. Speculators might do much worse than to buy up as many eggs of this bird as they can get hold of, for, although now carefully protected, it is to be feared that the specimens now existing are the last of their kind.

Collectors also pay good prices for the eggs of the golden eagle, the East Indian swallow, the Californian parrot or "popinjay," etc., and for those of all similar birds which make their nests in such inaccessible spots that their obtaining is a matter of difficulty and danger to life.

The ordinary barndoor fowl or "breakfast table" egg has also a fancy value—sometimes, to wit, when like wine it has "improved" with age. We rudely term such eggs "rotten." In China, however, such an egg is a delicacy of the first water, and the well-to-do pay high prices for a real good old egg of the "blue-blooded" type that has had "ample time to mature."

SCIENCE NOTES.

Curious experiments are being carried out by Capt. Simpson of the steamship "Moravian" to test the course and speed of ocean currents. For the past fifteen years, during the passage of this liner between Plymouth, South Africa, and Australia the captain has every day thrown overboard a tightly corked beer bottle containing a scroll bearing the latitude, longitude, and date when cast adrift, together with a request to the finder to forward the bottle to him at the London offices of the steamship line. The captain, who is a member of the British Meteorological Society, keeps a careful record of his daily operations. The number of bottles returned to him, however, is very small, the average being less than one per year.

The second law of thermo-dynamics may be formulated in different ways. It limits the possibility of natural processes to the occurrence of those in which a difference of intensity is diminished. If there is a difference of pressure in two parts of a gas, a movement will occur producing equality; if there is a difference of temperature, heat will be transported so as to produce equality once more. It is curious that such simple necessities, which we all feel as such, can be converted into far-reaching sharply formulated equations, as was done by Carnot and Clausius. These principles were first applied in chemistry by Horstmann. Then, by successive application to chemical problems by Massieu, Gibbs, Helmholtz and others, was won a system of relations touching the problem of affinity.

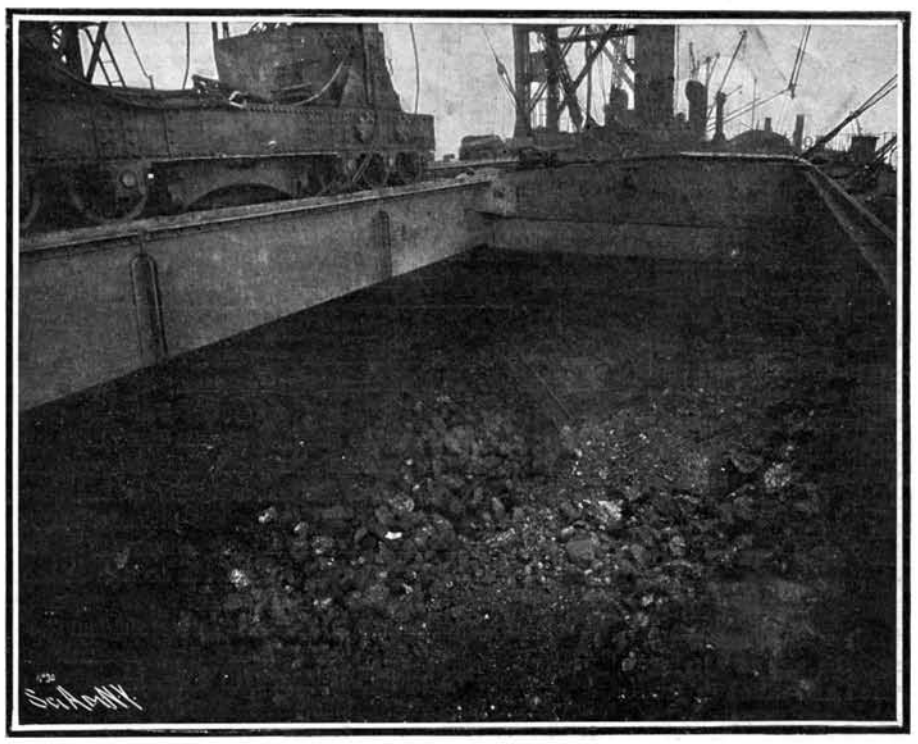
The bacteria and other microscopic forms of plant and animal life, all of which are conveniently included under the term microbes, have so lately begun to be understood and appreciated that we must still emphasize their extreme importance. The discoveries of the botanists and zoologists and revelations of the microscopists in this domain are comparable, in their importance to public health science, with nothing less than the revelations of the telescope to astronomy. Astronomy had indeed existed long before the invention of the telescope, and public health science had its beginnings nearly a century before any considerable progress had been made in micro-biology. But it is not too much to say that the developments in micro-biology since Pasteur began his work have not only revolutionized our ideas of the nature of the infectious diseases, but have also placed in our hands the key of their complete control.

Arrangements have been completed by a British corporation for the development of the extensive Australian shale fields, which are among the largest yet discovered in the world, and the manufacture of lubricating and illuminating oils, etc. The fields are located about one hundred miles from Sydney, the capital of New South Wales, in the fertile and well-watered valleys of Wolgan and Capertee. It is estimated that the fields contain many million tons of the richest shale. Every assistance possible is being rendered by the government to promote the success of the enterprise. A railroad about twenty-seven miles in length of the existing government gage is being laid, connecting the fields with the government trunk system. Electrical ore-cutting machinery is now in operation, boring a tunnel three miles in length through the heart of a mountain, which throughout its length is rich with shale deposits. By means of this tunnel the shale will be brought into direct communication with the extensive retorts and refineries that are in course of erection, the government railroad, and the port of Sydney. The Australian government in their latest financial report describe the industry as one of the largest that has ever been established in Australia, and which will ultimately eclipse all the others in size and value. Arrangements have been concluded for the exportation annually of hundreds of thousands of tons of shale to Europe and other parts of the world in connection with the manufacture of gas. According to the leading authorities on coal gas who have examined the shale, it gives the greatest quantity of gas and the highest illuminating power yet obtained.

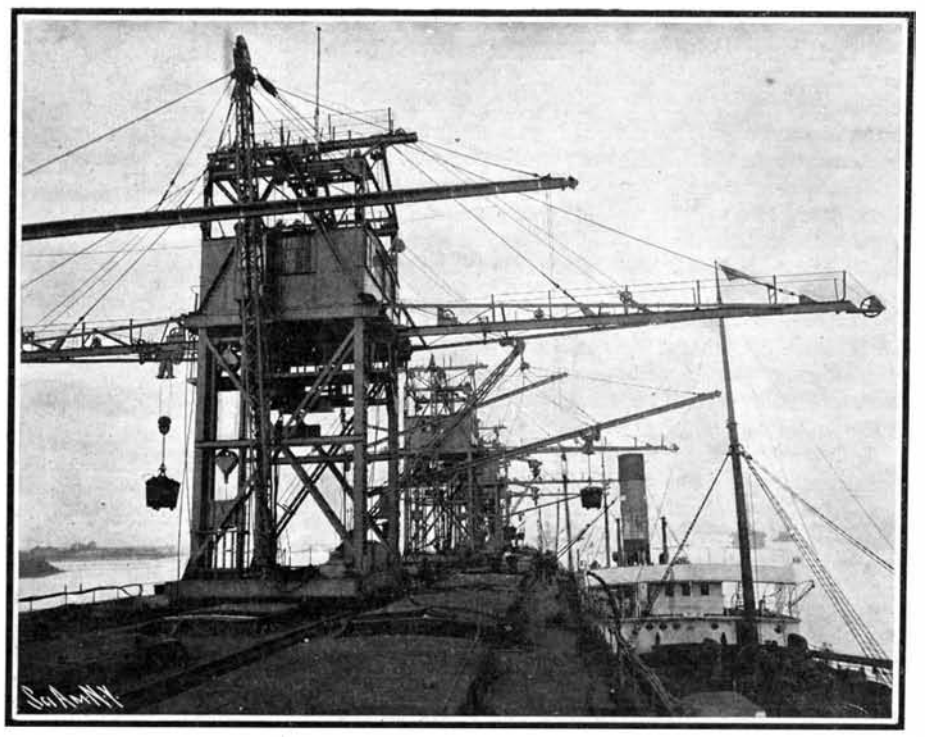
FLOATING DEPOT FOR COALING WARSHIPS.

BY DAY ALLEN WILLEY.

The British Admiralty has placed in service a floating depot for coaling warships, which is notable by reason of its great capacity, novel design, and the mechanical methods used for loading and unloading purposes. The coal depot, which is known as No. 1, has been utilized in the harbor of Portsmouth, where it has been tested in a variety of ways with such successful results, that it is understood the government will place several other depots at naval stations elsewhere.



One of the Compartments in Which the Coal is Stored.



Deck View of the Floating Coal Depot.

FLOATING DEPOT FOR COALING WARSHIPS.

As the illustrations show, the craft is of large dimensions. It is constructed of heavy steel plates, the framework being sufficiently massive to withstand the strain of the load of fuel as well as the machinery with which it is equipped. In reality, it is a huge barge which can be towed from harbor to harbor, if necessary, or to any convenient point in a harbor, while its capacity—12,000 tons of fuel—permits it to coal a small fleet of warships before its compartments are emptied. The hold is divided into a series of compartments, or large bins, which are covered with movable hatches like the compartments in the hold of an ordinary ship. The bottom plates of the storage bunkers, however, are V-shaped, allowing their contents to be transferred by gravity to other portions of the depot and at the same time assorted into lump and slack coal if desired. The compartments are arranged in two parallel rows with open galleries between them extending from the bottom to the upper deck.

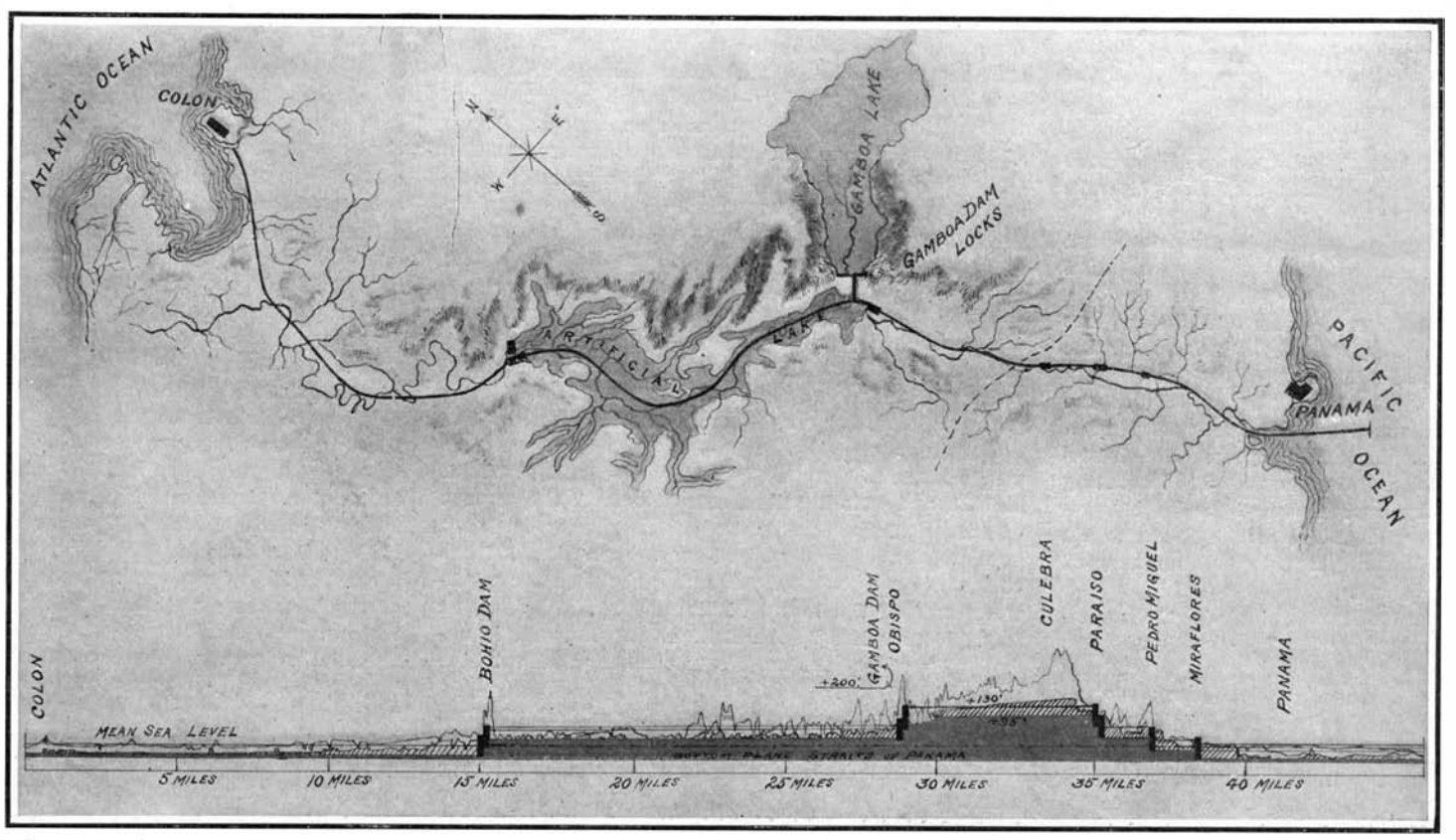
As the photographs show, a modification of the fast plant, so commonly utilized in this country in transferring cargoes on the Great Lakes, is employed. The depot is equipped with four Temperley conveyors, each consisting of a steel tower mounted upon rails, so that it can be moved forward and back, and adjusted to a hatch of the depot or the ship which it is to serve. Each tower supports a series of lateral tramways consisting of steel girders, which can be raised and lowered to a suitable angle. Beneath each tramway travels the bucket, which can be operated from any point between the extremities of the tramway by means of an automatic guide. The power is supplied by an electric motor; but to assist in overcoming the load of the receptacle, the chain holding the bucket is attached to a wire cable and sheave. The trolley system is utilized in hauling the buckets back and forth, as well as in the up and down movements, and as the tramways extend from both sides of each tower, two vessels can be coaled at once or the depot filled from both sides.

In addition to the tramway conveyors, however, the depot is also provided with a series of boom derricks—the arms being constructed of latticed steel work. These are auxiliary to the tramways, but are intended principally to serve the galleries to which we have referred. Frequently it is desirable for a warship to take on assorted fuel in bags. Nearly all of the manual labor required on board the depot is to fill the fuel bags with coal in the lump form. The lower portions of the bins open out into the galleries, and as fast as the bags are filled they are wheeled into these, when the fuel is lifted out by the derricks, swung over the side, and placed on board the receiving vessel. A half dozen or more bags can be transferred at once by means of the series of hooks which are attached to the boom cable, the hooks fitting into rope grips fastened to the fuel bags.

As may be inferred, the coaling depot contains an individual power plant, but all of the operations with the exception of filling the bags are performed by electric power. The current is generated by steam power, and transmitted by cable and wire system to the series of motors installed on the tramway towers. The boom derricks are also of motor design. The length of the depot allows the bunkers of a flotilla of gunboats to be filled at one time, while the reach of the tramway arms is such that two small vessels can lie abreast and be served by the mechanism. In the trials which have been made of the coal depot at Portsmouth, it has been hauled alongside of a dock, and a certain proportion of its cargo sacked and dumped on the dock in a given period of time. In another test the mechanism of the depot was employed to transfer its cargo to the dock, where the coal in bags was trundled on board a warship. As the photographs show, to keep pace with the charging capacity of the series of tramways, an entire ship's crew was required. Perhaps the most valuable feature of the depot, however, is that it is not only movable, but is available for serving vessels on either or both sides. It can also be utilized while loading cargo to coal the battleship or cruiser. While the bunkers of the war vessel are being filled on one side by the tramways and booms, the contents of the collier can be taken aboard by the mechanism on the opposite side. Indeed, the cargo of the collier can be transferred directly to the warship, the coal being taken across the deck of the depot by its conveying mechanism.

PROPOSED EXCAVATION OF THE PANAMA CANAL BY FLOATING DREDGES.

The plans for the rapid construction of a high-level canal, and its ultimate enlargement to a sea-level canal, which were presented in much detail by Mr. Bunau-Varilla before the Board of Consulting Engineers last September, is developed in general outline in the following article. Mr. Bunau-Varilla believes the best way to carry through successfully the great task which the United States government has set itself at the Isthmus is first, to build a high-level canal with locks, placing the summit level at an elevation of 130 feet, so as to secure a canal of the necessary depth and width with a minimum amount of excavation, and in the shortest possible time, which is estimated to be not over four years. When, at the expiration of that time, the canal is opened to traffic, the work of widening the waterway and cutting it down to sea level would proceed contemporaneously with the use of the canal for navigation. Mr. Bunau-Varilla explained to the Board of Engineers his special method of construction of the locks,

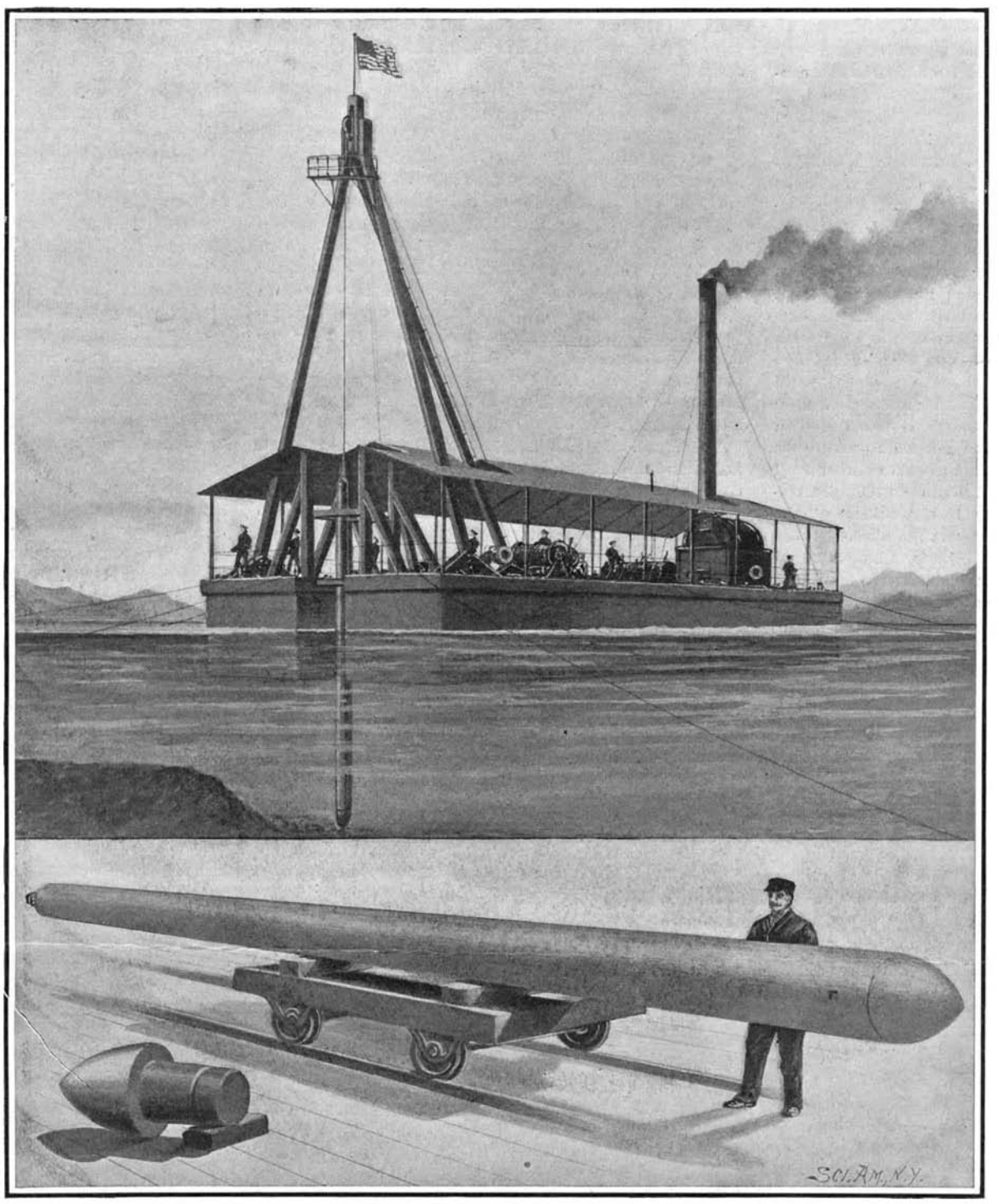


Map and Profile of Preliminary 130-Foot Level Canal at Panama, Proposed by Bunau-Varilla, Chief Engineer of the Former French Project.

PROPOSED EXCAVATION OF THE PANAMA CANAL BY FLOATING DREDGES.

and his plans for widening and lowering the level of the canal by means of floating dredges. He believes that by the use of special under-water excavating plant, both the cost and the time of building a sea-level canal would be greatly reduced.

METHOD OF TRANSFORMING FROM HIGH LEVEL TO SEA LEVEL.—The method of transforming the canal from high level to sea level without interfering with navigation is explained as follows: In the ordinary type of canal, the upper gate of a lock has a height equal to the depth of the canal, and it is supported on a massive vertical wall, which latter forms a base for the gate, and also acts as a retaining wall for the ground of the higher level. Evidently, in excavating the summit level down to the next level below it, it would be necessary to stop navigation while this foundation and retaining wall was removed, since the locks would be of necessity thrown temporarily out of service. To obviate this difficulty, Bunau-Varilla builds both the upper and the lower lock gate of exactly the same height, each of them being 80 feet in height (35 feet for the depth of the canal and 45 feet for the fall of the locks). It will be seen, upon referring to the accompanying sketch, that by this arrangement the 45 feet depth of material extending between the two summit-level gates, and reaching from the bottom of the summit level to the bottom of the next level below, a distance of 45 feet, can be excavated by floating dredges, without in any way interfering with the lock gates or with the navigation of the canal. Since all of the lock gates would be built of the same double height, it is evident that the successive levels could be dredged out down to the next level below, until the ultimate sea level had been reached. It is also evident that, after the earth and rock of each level has been excavated, the masonry of the locks could be blasted away, and the gates themselves could then be removed without difficulty.



This device is used for under-water excavation. The heavy chisel, weighing 15 tons, is shod with a hardened steel point. It is mounted on a twin scow and hoisted, and let fall, like a pile-driver hammer, by a hoisting engine. By its impact it fractures the rock bottom and breaks it into easily-dredged fragments. It is with machines of this type that Bunau-Varilla proposes to excavate the rock in the Panama Canal.

A Lobnitz Rock-Cutter in Operation, and One of the 15-Ton Hammers.

METHOD OF EXCAVATION WITHOUT INTERFERENCE WITH NAVIGATION.—The preliminary 130-foot-level lock canal of Bunau-Varilla's proposition has a depth of 35 feet and a bottom width of 150 feet. His proposed sea-level canal is to have a depth of 45 feet and a bottom width of 300 feet, and his proposed "Straits of Panama" would be 500 feet wide on the bottom. In one of the accompanying diagrams is shown the method by which he proposes to carry on excavation after the opening of the canal, without interference with navigation. His first step would be to excavate the mass of material, representing that part of the sea-level canal prism lying above the 130-foot level, by the "dry process," that is to say, by means of steam shovels and trains of cars running over ordinary construction tracks. When this material had been taken out down to the surface level of plus 130, Bunau-Varilla would introduce his system of excavation by floating dredges. He would first cut a working canal parallel to the navigation channel, and extending through the full length of the summit level. In this he would place dredges and self-dumping scows. The softer material would be dredged directly from the bottom, and the harder material would be removed by mining and dredging, or by the use of what are known as the Lobnitz rock-cutters, in which the rock bottom is broken up by pounding it with heavy 15 or even 20 to 30-ton hammers, of the kind shown in the illustration.

The Lobnitz rock-cutter is a device which has been in successful operation on several important works, and notably in the Suez Canal, where the bottom rock was broken up into a condition suitable for dredging at the expense of twenty-five cents per cubic yard. Bunau-Varilla estimates that the hardest rock in the Panama excavation, if 25 to 30-ton hammers were used, could be broken up for from 75 cents to $1 per cubic yard, if using steam power. If electric power, generated by the Chagres River, is used, he believes that these figures can be reduced by one-half. The Lobnitz hammers are operated in much the same way as a floating pile-driver, the hammer being raised by steam hoist to a sufficient height to give the necessary blow, and then let fall. With 15-ton hammers ordinary rock is broken up, to about a depth of 3 feet, into fragments of a size suitable for dredging.

The new channel to the right of the navigation channel (see cross-section diagram) would be excavated to a depth of 50 feet from the navigation channel up to the slope of the sea-level prism, as shown by the dotted line. When this was done, the navigation tract would be shifted into the new channel, while the old channel, 35 feet in depth, was being excavated to the 50-foot level. The water would then be dropped 15 feet, and the navigation channel brought again to its original position on the left-hand side of the cut. By this arrangement the dredges, mining and stone-breaking apparatus, scows, tugs, etc., would be kept separate from the canal proper, and navigation from ocean to ocean could be carried on continuously until the whole prism was finally excavated down to about 45 feet below sea level.

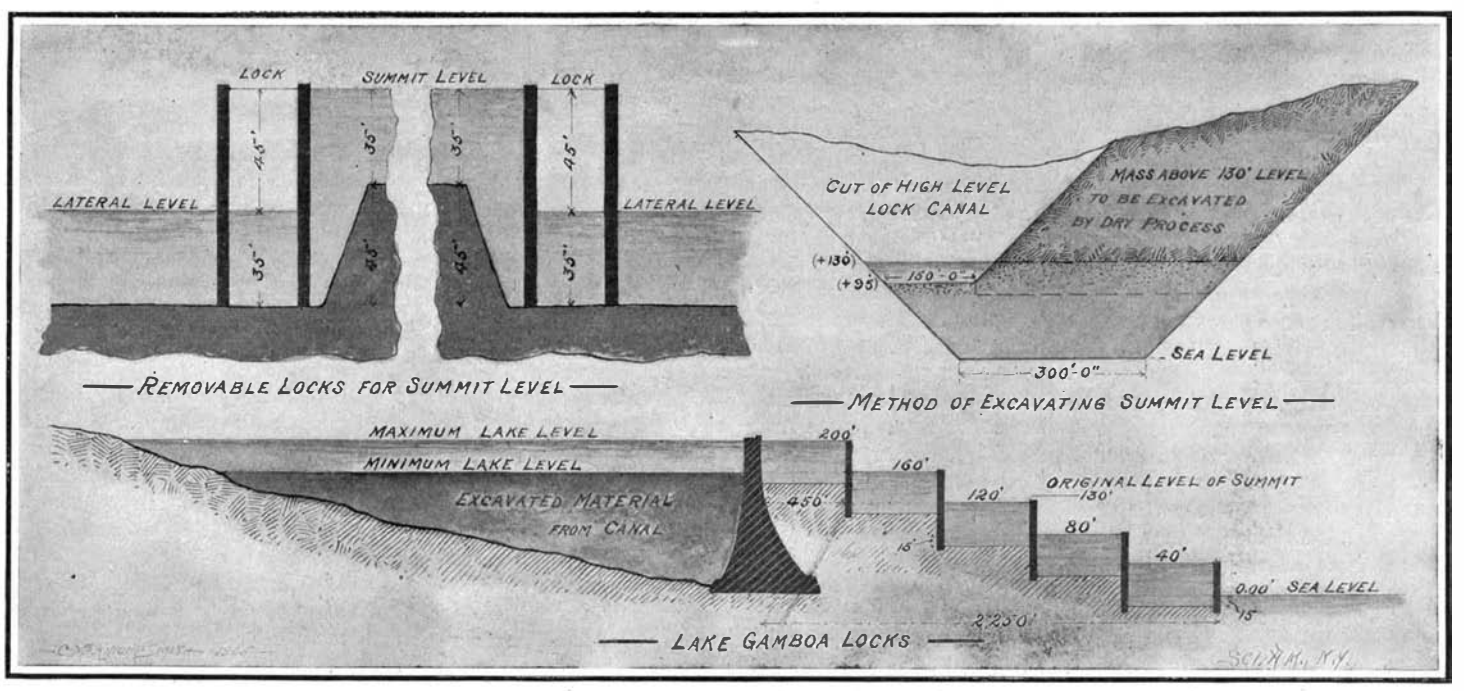


Diagram Illustrating the Proposed Methods of Excavating the Panama Canal by the "Wet" Method and Disposing of the Material in Gamboa Lake.

PROPOSED EXCAVATION OF THE PANAMA CANAL BY FLOATING DREDGES.

METHOD OF DISPOSAL OF THE EXCAVATED MATERIAL.—It is pretty well agreed that one of the most difficult problems at Panama will be the disposal of the enormous amount

of excavated material, most of which will come from the Culebra cut. Bunau-Varilla claims that he can cut the Gordian knot by dumping the greater part of it into the Gamboa lake. Now Gamboa lake, as will be seen from the accompanying map, is to be formed by the construction of a huge dam, whose crest will be 200 feet above the sea level, and which will extend entirely across the Chagres Valley at the point where the river Chagres first intercepts the line of the canal. All of the various schemes for the control of the heavy and sudden floods of the Chagres contemplate the construction of a reservoir, whose waters shall be held normally at such a level that there will at all times remain sufficient unoccupied space back of the dam wall to contain and hold all the waters of a Chagres flood. The minimum normal stage of the water in Lake Gamboa is plus 160, and there is sufficient capacity between that level and plus 200 to contain the river floods. Bunau-Varilla argues that, this being the case, the interior of the dam below the 160-foot level might be turned to good account by using it as a dumping ground for the excavated material. Accordingly, he would connect the waters of the lake with those of the summit level by a double flight of five locks. The material excavated by the dredges would be dumped into scows, which would be towed along the excavated canal in the channel opened parallel with the navigation channel, and after ascending the flight of locks, would be towed into Gamboa lake and unload themselves by opening their bottom gates. Bunau-Varilla estimates that eight dredges, working at the summit level, would in seven years dispose of the 110,000,000 cubic yards that would have to be excavated between the Obispo and Paraiso lock. There would be two chains of five locks, one for ascending and the other for descending. They would be able to take in one lockage four scows, 200 feet long, 40 feet wide, and drawing 14 feet of water. As each scow could carry 750 cubic yards, each lockage would lift 3,000 cubic yards, which would correspond to the passage into Gamboa lake of 96,000 cubic yards every twenty-four hours, or 30,000,000 cubic yards a year. Basing his figures on an estimated cost of excavation for hard rock of 65 cents per yard, for soft rock of 35 cents, and for earth of 20 cents per yard, he gets a total cost for excavating a 500-foot wide canal of $232,500,000. To this he adds for the cost of harbors, dams, electric power, etc, $17,500,000, and twenty per cent for emergencies. He finally arrives at a total cost of $300,000,000 for his "Straits of Panama," which would take twenty-four years to construct, including four years for the building of the preliminary 130-foot-level lock canal. The comparatively low estimated cost of the canal is explained by the fact that the excavation is done by the under-water method instead of the dry method, and that the power would be furnished by the impounded waters of the Chagres River, whose energy would be electrically transmitted throughout the whole length of the canal.

We offer no criticisms on the above remarkable scheme, which would probably have had a better chance of recommending itself to the Advisory Board, did its successful execution not depend so absolutely upon methods of excavation and disposal that have yet to be tested upon a grand scale.

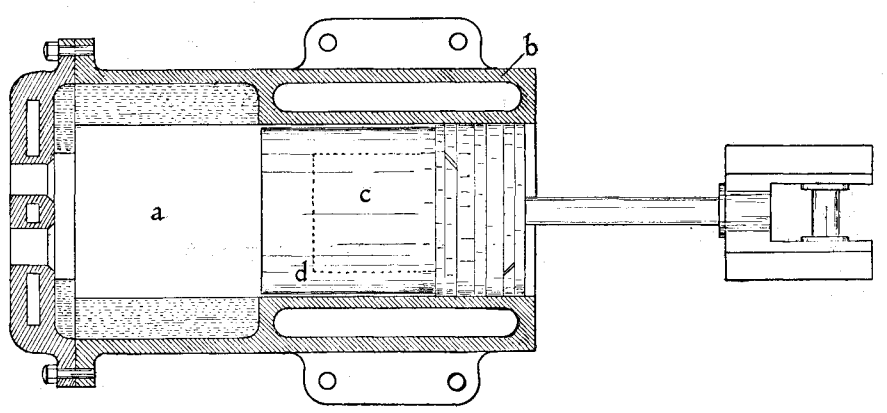
A RATIONAL METHOD OF COOLING GAS-ENGINE CYLINDERS.

BY S. M. HOWELL.

It is a matter of common observation in gas-engine practice, that an air-cooled cylinder will develop somewhat more power than could be secured from a water-jacketed motor of equal size, and under otherwise equivalent conditions. In other words, the engine without water cooling is the superior in point of economical performance. This experience agrees perfectly with the well-known simple theory upon which the production of power is dependent in all forms of the internal-combustion motor. The gas engine is a heat motor, pure and simple, producing power solely by the development and conservation of a high degree of heat. The working fluid is a mixture of air and certain inflammable gases, and the whole is violently expanded by the instantaneous burning of the contained gas and the intense heat thus generated. It must follow, therefore, that a water jacket or any device which operates to dissipate the heat of combustion, prior to the moment of the exhaust, will also lower the pressure and curtail the power of the engine in a corresponding degree. In the case of the water-jacketed engine, the cylinder walls have a comparatively low temperature, and rapidly abstract heat from the burning charge, thereby reducing the pressure and diminishing the power of the stroke. But the so-called air-cooled engine, having a much higher temperature, will therefore develop a higher pressure, and for a time at least, or until the cylinder becomes excessively hot, will produce more power. The amount of heat lost through the walls of a gas-engine cylinder by the use of a water jacket varies with the conditions. A high piston speed and high compression are factors which have a marked effect in reducing this loss; for the reason that in such cases the cylinder is smaller than would otherwise be required to develop the same power. This reduces the extent of water-cooled surface with which the ignited gases are in contact, and also, by reason of the quicker stroke, shortens the time of such contact.

The amount of heat absorbed by a water jacket may readily be determined in any given case by a simple calorimetric test of the water used, taking note of its volume, and its temperature as it enters and as it leaves the jacket. But I have observed, in making experiments of this kind, that the figured result does not always account for the deficiency which exists in the power of the engine, as compared with the heat which should theoretically be developed, and that too after making fair allowance for all other apparent losses. In explanation of this, it may be urged that the full temperature and the total amount of heat generated by the complete burning of the fuel, is not, in the case of a gas-engine cylinder, fully developed. The combustion is more or less imperfect by reason of contact with an extended metallic surface at a comparatively low temperature. If this is true, then we have also an indirect loss caused by incomplete combustion, and chargeable to the use of water cooling.

The hydro-carbon liquids or gases, which are the usual fuel of gas engines, consist essentially of hydrogen and carbon. The hydrogen is readily inflammable, and under ordinary circumstances is capable of but one reaction, resulting in the formation of the vapor of water. The elastic force of this vapor, powerfully compressed within the confines of the cylinder by the heat of combustion, forms a large part of the working fluid by the pressure of which the piston is driven. The trouble would seem to arise from a deficiency in the burning of the carbon element. Carbon in burning may



A NOVEL WATER-JACKETED, HIGH-PRESSURE CYLINDER FOR A COMPOUND GAS ENGINE.

form either of two combinations—carbon dioxide or carbon monoxide. The former is always the result under fairly favorable conditions, but in some cases, notably those in which the flame is confined within narrow limits and in close contact with metallic surfaces, the heat is so rapidly withdrawn that the temperature falls, and the process degenerates into incomplete union with the oxygen of the air, and the formation of carbon monoxide, the difference being that the amount of heat liberated by this degenerate reaction is less than one-third that which would result from perfect combustion of the carbon and the formation of carbon dioxide. A familiar instance of this defective form of combustion is seen in the attempt to pass a gas flame through a sheet of gauze or cloth made of fine metallic wires, or to conduct a flame through small metal tubes. In these cases, the cross-sectional area of the passages is very small, and the extent of cold metal comparatively large, with the result that the temperature falls below the kindling point, and the flame is extinguished or reduced to the monoxide reaction described above. That these instances have a parallel in the conditions which exist in gas engine practice, seems probable. It is obvious, however, that such an effect must be more marked in the case of small engines than in those having large cylinders, and could be determined in any case by a careful analysis of the exhaust.

In regard to other methods of cylinder cooling, little need be said. Aside from the various methods of air cooling, the injection of water directly into the cylinder seems to be the only alternative. But this method, unless very sparingly applied, is worse than the use of an external jacket. It was one of the first cooling systems tried in the early days of the gas engine; and although modern designers sometimes attempt to revive it, it has usually proven unsatisfactory. This is evidently for the reason that the water in direct contact with the burning charge must greatly modify its temperature, while the cylinder walls would be only indirectly affected, and might still be insufficiently cooled. Then, too, the introduction of too large an amount of water into the cylinder of a gas engine, resulting of course in the immediate production of a body of steam, antagonizes combustion, and renders the ignition more difficult, and in the case of a four-cycle engine, has a tendency to destroy the vacuum produced by the retreat of the piston, filling the cylinder with steam on the suction stroke, and thus interfering with the inspiration of the charge. And still it is true that a small quantity of water, if properly regulated, may be injected into the cylinder of an air-cooled motor with much advantage. In this case it moderates the excessive heat of the contact surfaces, and assists lubrication by saponifying the oil and loosening any carbon deposit, which may otherwise adhere to the cylinder walls.

But after demonstrating the disadvantages of water cooling, the fact still remains that red-hot metal surfaces can not be continuously worked under heavy pressure in air-tight contact. Some means must be adopted whereby the destructive effects of heat on the cylinder and piston may be obviated. Thus it seems that in the present state of the art, the efforts of the gas engine designer are opposed by a conflict of natural conditions, and that he must so construct his engine that durability will be secured at the sacrifice of economy. But let us see if there is not a remedy.

In the figure which accompanies this article there is shown the high-pressure cylinder and piston of a compound gas engine, built upon a system which has for its object the utilization of the greatest possible amount of available heat in a cheap liquid fuel, viz., crude or partly refined mineral oil. It may be noticed that this cylinder consists of two parts, viz., the combustion chamber *a*, the internal walls of which are protected from the heat by a lining of refractory material, indicated by the dotted surfaces; *b* is the cylinder proper, wherein the piston and rings work in air-tight contact. This part of the cylinder is water-jacketed in the usual manner. The admission and exhaust valves are located in the head of the combustion chamber, this member being also partly jacketed to protect the valves. The piston *c* is the elongated type, that is, of somewhat more than the usual length, and having the rings near the forward or open end, the other end being covered by a thick cap *d*, of the above-mentioned refractory material. The elongation or extended part of the piston, with its refractory cap, is slightly smaller than the bore of the combustion chamber lining. This allows the elongated part to reciprocate within the combustion chamber, and to effect the necessary displacement without actual contact. Leakage past the piston is stopped by the rings at the opposite end which works within the cool part of the cylinder proper. The exhaust passes into a second and larger cylinder on the same shaft, where it delivers its remaining power in the well-known manner common to all compound engines. The cycle may be either two or four, but in either case, pure air alone will be admitted on the charging stroke. This air is compressed on the return stroke to a very high degree—300 to 500 pounds per square inch. The oil begins to enter (forced in by a pump) at the commencement of the power stroke, and without the use of any igniting device whatever, is instantly fired by the heat of compression, maintaining the required pressure throughout the stroke, in the manner of those engines which operate upon the well-known continuous combustion system.

A gas engine constructed upon these lines would possess the following advantages: It would be perfectly adapted to the use of the cheapest liquid fuel known. The injurious effects of heat upon the working faces of cylinder and piston would be avoided. The losses incident to the use of the water jacket would be totally eliminated. The conflicting requirements encountered in the present methods of design would be obviated. The engine would be as durable as any other, and its thermal efficiency would be the highest possible in a heat motor.

Concerning the advantage of compounding, it should be observed that the exhaust from an engine operating upon the above system has a very high pressure (100 pounds per square inch) and the gain by this means would therefore be considerable.

Regarding the character of this proposition for a new gas engine, it is virtually a composition of at least three expired patents, and its value therefore does not consist in the novelty of its elements, but in the peculiarity of their combination. Certain other known devices might also be involved in its final construction, but this would depend upon the mechanical details of the arrangement by which the oil was delivered to the cylinder, rather than on the operative principle of the engine.

The temperature of the linings and piston cap—owing to the constant inspiration of fresh air through the inlet valve—would never exceed a dull red heat, and

the valves would not become much hotter than is ordinarily the case in any gas engine.

The drawing shows the piston at the extreme end of its outward stroke, the length of which is in this case, about equal to the cylinder bore.

It is not essential the compression pressure should be as high as 500 pounds (mentioned above), as the charge would be self-igniting at a point considerably below this figure.

The Current Supplement.

The opening article of the current SUPPLEMENT, No. 1568, deals with the Rhodesia railways in South Africa. The article is very fully illustrated. Mr. Houston Lowe presents his views on factors in painting woodwork. The excellent article on the dimensions of the marine steam turbine is concluded. This is by far the most important contribution to the literature of the steam turbine which has thus far appeared. Interesting from the naturalist's point of view, is an interesting article on the manner in which animals feign death. Notwithstanding the tendency of scientific knowledge and general enlightenment to dissipate superstition, some people still believe in the divining rod. The whole subject is discussed thoroughly in an excellent article by George M. Hopkins bearing the title "Unscientific and Scientific Divining Rods." In the industrial progress of this country there is no feature more remarkable and striking than the growing use of concrete building blocks. Mr. S. B. Newberry reviews the subject thoroughly, and gives some helpful suggestions. Lieut. Henry J. Jones continues his discussion of armored concrete. The electric conductivity of a vacuum is the subject of an article by Prof. J. A. Fleming.

BROMELIA FIBER.

BY CHARLES RICHARDS DODGE.

Among the collections of fibers from tropical America, shown at expositions held in our own and foreign countries, has frequently appeared a long, silky vegetable fiber, of a greenish cast of color, and showing great strength, though only an expert might particularly notice the small hanks into which the fiber is made up. When a specimen is unwrapped, however, the fineness of the fiber, and its extraordinary length, become apparent, for six feet is a common length, and I have seen examples that were very much longer. So strong is the fiber that it is difficult to rupture even a few filaments, by direct strain, without cutting into the hands.

I have seen the fiber, in very small quantities, in different portions of Mexico, where it has been sold, locally, as high as one dollar per pound. It is produced from the long, narrow leaves of a "wild pine-apple" belonging to the genus *Bromelia*. The nomenclature of the species is so confused, however, that I hesitate to name it, for the fiber has been variously labeled, in the museums and at expositions, *Bromelia sylvestris*, *B. pita*, *B. pinguin*, *B. karatas*, and *Karatas plumeri*. Its most common names are pita, pinuella, pinguin, and silk-grass, though "pita" is meaningless, and "silk grass" is applied to so many other fibers that the name is worthless. The better names are pinuella and karatas.

In the region of southern Mexico, from Oaxaca to Vera Cruz where the plant grows in great profusion, the fiber is used largely for fine woven textures, where strength and durability are essentials, such as hunting bags and various forms of pouches. It is also used for sewing thread, and was formerly employed for sewing shoes. The fiber is cleaned by hand, and the great length of the thin, narrow leaf, which is armed along its edges with sharp spines, makes it a tedious operation; hence the high price of the fiber.

I have just been informed by a correspondent in Mexico that an effort is being made to clean the leaves of the wild pine-apple by machinery, and some fair examples of the fiber have been turned out experimentally, in small quantities, so that future experiments are looked forward to with interest. The difficulties in the way of machine extraction are largely due to the thinness and the length of the leaf, a machine powerful enough to scrape off the hard epidermis inclosing the fiber layer being too harsh in its action, thus injuring the fiber. The production of well cleaned, unbroken fiber by machinery, and in commercial quantity, would no doubt give our manufacturers a new textile which might enter into some of the present uses of flax, while the peculiar silkiness and the color of the fiber would adapt it to the manufacture of many beautiful woven articles such as fancy bags, and even belts for summer wear. It would doubtless make superior fishing lines, and with further preparation and bleaching there is no saying but that the fiber might be employed in a wide range of woven fabrics of great beauty. Savorgnan, an Italian authority, states that in Brazil and Guiana, where a similar (if not the same) plant abounds, the fine silky fiber is manufactured into many "articles de luxe." In an old work on Mexico a species of Bromelia is referred to which is said to yield a very fine fiber six to eight feet long, "and from its fineness and toughness it is said to be commonly used in belt-making works. It also finds application in the manufacture of many articles such as bagging, wagon sheets, carpets, etc., besides being a valuable material for making nets, hammocks, cordage, and many articles in common use." This undoubtedly refers to the common form of Bromelia which is the subject of this article.

A species of shorter-leaved Bromelia grows in Paraguay and Argentina, producing a somewhat similar fiber, which is known as Caraguata, the product of *Bromelia argentina*. The filaments from this species are rarely longer than four feet, and while the fiber is soft and strong, it does not compare with the pinuella fiber from the region of Oaxaca, Mexico. In "The Capitals of Spanish America," by William E. Curtis, (page 638) a beautiful lace called "Nanduty," made by the women of Paraguay, is referred to. The fibers employed are described as very fine, and as soft and lustrous as silk. "Lopez had his chamber walls hung with this lace, on a background of crimson satin, and the pattern was an imitation of the finest cobweb. It is said to have required the work of 200 women several years to cover the walls." The name "pita" has been given to the fiber used in the manufacture of this lace, and the name, taken in connection with the description of the fiber given above, would seem to indicate that it was derived from a wild pine-apple, or Bromelia.

Bromelia fiber is closely allied to the famous piña, or pine-apple fiber of the Philippines, from which are manufactured such marvelously beautiful textures—such as fabrics fit for ball dresses, and handkerchiefs of gossamer fineness. There is little doubt, with as careful preparation, some of the wild pine-apple fiber might be employed in the same manner.

BROMELIA FIBER AS IT GROWS IN MEXICO.

The plant shown in the illustration was photographed in the old Borda garden of Cuernavaca, Mexico, where it is known as the piñuela. The masses of leaves in front have been broken off, and only those in the center show the full length. In British Honduras the leaves are said to grow from 5 to 15 feet in length.

The rusts of cereals in damp seasons often destroy these crops or greatly reduce the yield and quality of the grain over immense areas, thus causing serious loss and suffering, and often famine. Many species of rusts have been discovered, some more destructive than others. The parasites causing the disease have been in some cases carefully studied, but much of their life history and habits remains yet to be learned. One of the most important facts discovered is that some of the most destructive forms, like the black rust of wheat (*Puccinia graminis*), have several distinct stages, formerly believed to be entirely separate fungi and to have no connection with each other. When De Barry found, however, that the cluster-cup rust of the barberry was a stage of the wheat rust and that the wheat was infected from the spores of the barberry rust a common observation of farmers was explained, namely, that wheat rust is most severe near barberry hedges. Laws were passed requiring the destruction of barberry hedges, and this particular form of wheat rust was then greatly reduced. The investigation also demonstrated that the black-rust stage on wheat could not infect the plant directly, but could infect the barberry, producing the cluster-cup rust of that plant. The spores of the barberry rust were found not to infect the barberry, but the wheat plant, producing first the form known as the red rust on the leaves and developing later on the same plant into the black rust.

Correspondence.

The Coiled Spring Problem.

To the Editor of the SCIENTIFIC AMERICAN:

In the late discussion as to what becomes of the coiled spring's energy when it is dissolved in acid, it has seemed to the writer that one point has been overlooked; namely, that the amount of heat liberated by the oxidation of the iron is so great, as compared with the heat equivalent of the stored mechanical energy, that no calorimetric method would be capable of measuring this additional heat.

A specific case may serve to make this plain. If a spring weighing 500 grammes is dissolved in acid, the oxidation of the iron will liberate 791 large calories (kilogramme-centigrade heat units). Although the writer has no acurate data of the stored energy in a coiled spring of the above weight, yet it would seem that 20 kilogramme-meters would be a rather liberal allowance. This amount of energy is equivalent to 0.0468 large calorie, or less than one ten-thousandth of the heat liberated by the oxidation of the iron.

While as a matter of theory it is apparent that the stored energy of the coiled spring must reappear as heat, yet the foregoing example makes it evident that it would be difficult, if not impossible, to demonstrate the fact. GREENLEAF W. PICKARD.

Amesbury, Mass., January 8, 1906.

Safety on Railroads.

To the Editor of the SCIENTIFIC AMERICAN:

Public sentiment in favor of the block signal has been thoroughly aroused of late, as a result of the alarming frequency with which serious accidents have occurred on our railroads. The general adoption of this form of safeguard is a step in the right direction, and it is to be hoped that it will be made compulsory throughout the country.

While the block signal is capable of a high degree of development, it usually takes the form of a simple visual signal, and as such is open to the serious objection common to all visual signals, that it has no power to enforce obedience to its behests. The method of controlling our great modern trains entirely by human agency, depending for guidance upon colored lights and movable semaphore arms, is absurdly primitive and ineffective. The all-important question as to whether the signals are to be obeyed or not depends absolutely on the engineer, who, like the rest of us, is subject to all the frailties of mankind. He forgets and becomes confused; his attention may be distracted at a critical moment; he may sleep or even die at his post, as has actually occurred several times within a few months; he sometimes does what is worse, deliberately "runs" signals to save time.

In view of these conditions, the writer desires again to urge the compulsory use of the automatic stop or "tripper," in connection with the block signal, as the only way in which a strict regard for the latter can be enforced. This must in no way be taken as a suggestion to relieve the engineer of any of his present responsibility. He should devote his entire skill and energy to the safety of his train, but his efforts should be supplemented by automatic devices, which will make it physically impossible for him to pass a danger signal whether he will or not.

The principle of automatism in safety appliances is recognized as an essential in modern mechanical systems, and may properly be regarded as a fundamental principle of safety. How the railroads have been permitted to ignore it in the matter of stopping trains is difficult to understand.

The reprehensible practice in vogue on many roads of regarding block signals, spacing signals, and time fuses as merely cautionary or informatory, and of running trains until the actual obstructions are encountered, deserves severe condemnation. It is a mercenary subterfuge to gain time at the expense of safety, and ought to be treated as such. A certain minimum distance between trains should be preserved in the interests of safety, and nothing should justify any encroachment upon this margin. A train arriving at an opposing block signal ought to be required to stay there until the block is cleared, even if a few minutes are lost in consequence. The saving in time should be effected by keeping the track clear, and not by disregarding danger signals.

The contention of the railroads, that their traffic could not be handled were trains required to stop at block signals, is not worthy of serious consideration. When reduced to plain language, it means simply that the earning capacity of the road would be somewhat diminished if danger signals were always regarded as they should be, and the practice of stealing time at the expense of safety were abandoned.

The block signal should be installed on every railroad, and a proper regard for it should be enforced by the law backed by the automatic stop.

WILLARD P. GERRISH.

Harvard College Observatory, Cambridge, Mass., January 1, 1906.

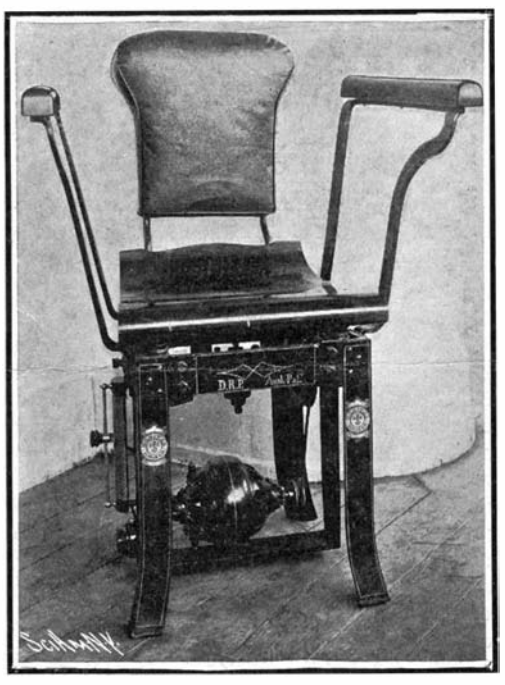
A CHAIR DESIGNED FOR THE PREVENTION OF SEASICKNESS.

The cures or preventives for seasickness which have been proposed are almost without number. The majority of them, however, attempt to counteract the unhappy effects of the ship's movement by the use of drugs or chemicals, while the methods employing mechanical means are not so numerous. A novel device has recently been added to the latter category; and while its promoters do not claim to cure seasickness by means of the apparatus, they do claim that they are able to prevent that unpleasant malady during the time that the traveler makes use of the mechanism. The apparatus is the invention of Dr. Carl Brendel, of Tschupackowka, Russia, and is being experimented with by a prominent German electrical firm.

The invention, which is by no means confined to the form of apparatus shown in the accompanying illustrations, consists essentially in making the movements of the ship when pitching, rolling, heaving, and setting less felt by the passengers, by providing special chairs, couches, or a whole platform forming part of the deck, and giving to these, either by machinery or by hand, short up and down movements. Consequently, as the long movements of the vessel are thus changed into a great number of short motions, which are constantly interrupted by brief movements in an opposite direction, the causes producing seasickness are counteracted. The form of device illustrated in the engravings consists of a chair with the seat movably arranged with respect to the legs, arms, and back. The short up and down movements are given by a small electric motor located between the legs of the chair, and connected by means of a belt with an eccentric actuating the seat. The speed and intensity of the movements can be regulated between considerable limits by means of suitable devices incorporated in the mechanism.

The chair, which was brought to this country by R. and W. Otto, was extensively tested on a recent voyage of the Hamburg-American liner "Patricia." A number of passengers, who were badly upset by the pitching of the ship, tried the device, and declared that while they were in the chair, they felt no symptoms of illness, but when no longer using it, the seasickness in some cases at once returned, although not in others.

The chair has been tried on the English Channel steamer "Peregrine" between Hamburg and Harwich, and on the Hamburg-American mail steamer "Patricia."



A Chair Designed to Prevent Seasickness. The Seat is Movably Arranged and is Reciprocated Rhythmically by Means of an Electric Motor Connected by Means of a Belt with an Eccentric Actuating the Seat.

A CHAIR DESIGNED FOR THE PREVENTION OF SEASICKNESS.

Some New Ideas About Food.

The important question of the physiology of nutrition is fully considered by Dr. Frank Billings in a recent issue (November 4) of the Journal of the American Medical Association. It is especially important to the physician, for without a clear idea of the subject he cannot prescribe a proper dietary for the well or sick, nor can he clearly understand the result from malnutrition.

According to the author, it is the belief of the layman and of many physicians, too, that the chief nutrition of food consists of the proteids, and that meat, especially, is looked upon as the food which affords strength and sustained effort. Among Europeans and Americans especially meat eating is very prevalent, chiefly for the reasons given above. Besides this, the palate is pleasantly excited by rich animal foods, and in consequence a larger amount is taken. It is too common a belief that the well-nourished body is the most healthy and best able to resist disease, and that a large fat deposit in the tissue is an evidence of good general nutrition.

"Our food," says the doctor, "is made up of proteids, fats, and carbohydrates. The proteid or albumen, both animal and vegetable, is the tissue builder. Relatively, a larger amount of proteid is required for the growing individual, pound for pound, than for the adult. The fats and carbohydrates (sugars and starches) comprise the fuel of the body, and supply the necessary heat and keep the machinery going."

Dr. Billings cites the standard of Carl Voit, of Munich. Voit considers that a normal man of an average body weight of 150 to 165 pounds, doing a moderate amount of work, requires daily 118 grammes of proteid, 55 grammes of fat, and 500 grammes of carbohydrates. This gives a total food value of about 3,000 calories, and will maintain the body in a good physical condition.

The fate of the elements, when taken into the body, we are told, is as follows: "Fats and carbohydrates, when oxidized in the body, are ultimately burned to simple gaseous products, that is, carbonic acid and water. Consequently, the waste from these food products is quickly thrown out of the body without resulting harm to any of the tissues. If such products are taken in excess, the harm which results will be chiefly in the deposits of fats in an undesirable amount, which would render the body gross and unwieldy. A too large amount taken is very apt to clog the alimentary canal, overfatigue the digestive organs, and may undergo abnormal fermentation.

"The waste products of proteid foods, when assimilated, consist of crystalline nitrogenous products, which ultimately pass out of the body, chiefly through the kidneys. Before their elimination from the body these crystalline elements, which are in some instances toxins, float about through the body, and may exercise a deleterious influence on the organism, either general or local. The literature is full of theories on the diseases due to many of these crystalline products, chiefly uric acid, urea, etc. All who are acquainted with these facts have recognized the importance of restricting the formation of the deleterious crystalline waste products by limiting as far as possible the amount of proteids taken into the body."

Until recently it has been the belief that the nitrogenous equilibrium of the body could not be maintained on a less amount of proteids than that given in the standard diet of Voit and others, but of late far-reaching experiments have been made on the physiology of nutrition and of metabolism of the body, which practically revolutionize the ideas held by most physiologists.

Reference is made to experiments conducted by Prof. R. H. Chittenden, of Yale University, that demonstrated conclusively that men from all classes of individuals, in regard to mental and physical work, could meet all ordinary requirements of mental and physical labor with a high efficiency on an intake of proteid food far below that of the standard diets. It was found, too, that in the reduction of the proteid it was not necessary for these individuals to increase very much, if at all, the amount of fats and carbohydrates to maintain themselves in good condition.

Attention is called to the evils of insufficient mastication which entails an enormously increased work on the digestive organs.

"An excess of proteid in the food," the doctor tells us, "is not stored up in the body as such, for the actual need of nitrogen is very small, as it is limited to the actual building up of the cell bioplasm. It is not necessary to store it in the body, because an excess of nitrogen is always furnished with the food. A larger nitrogen intake than is necessary to meet the needs of endogenous metabolism will lead only to an increase in the elimination of urea."

It is stated that the organism, at any time, may be made to store up fats and carbohydrates, if an excess over the requirements is taken. An excess, however, may overburden the digestive organs and cause abnormal fermentation. Too large a deposit of fat may render the body unwieldy, and may infiltrate and physiologically embarrass the muscles and viscera.

The author draws the conclusion that the so-called standard diets are unnecessarily rich in proteids. "It is necessary to supply protein in the food," says he, "in sufficient amount to provide liberally for the endogenous or tissue metabolism and to maintain a reserve protein in solution. If the blood is in need of tissue builders, the organism can rapidly assimilate large amounts of nitrogenous food. This is clearly shown in emaciated conditions following fevers, surgical operations, etc., for during convalescence there is often a ravenous appetite and a rapid increase in weight and strength with a corresponding retention of nitrogen. . . . The growing individual and the emaciated convalescent only can utilize a large nitrogen intake and retain it. The difference in the dietary of grown normal individuals will consist mainly in the fuel foods—the fats and carbohydrates."

Dr. Billings contends that the achievements of the Japanese on a diet chiefly carbohydrate is sufficient proof that a high efficiency, both mental and physical, may be maintained on a low proteid and full fuel diet

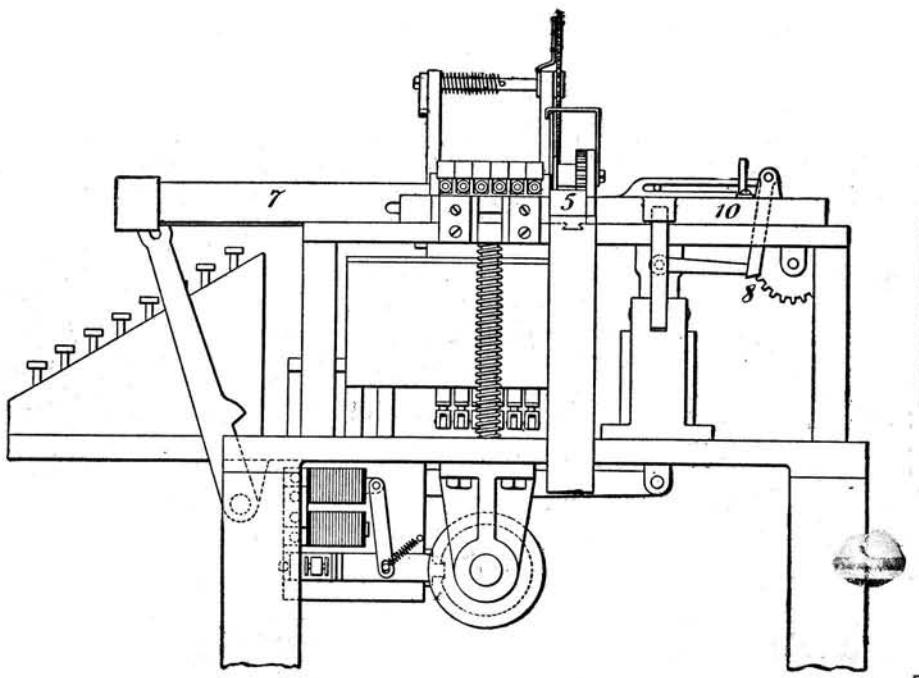
The question whether a large proteid diet is not only unnecessary but also detrimental is answered by the doctor in the affirmative. "The continued excessive use of protein," says he, "may lead in time to the accumulation of a larger amount of reserve protein than the organism can maintain in the fluid media. The continuous unnecessary supply of unorganized reserve material may weaken one or all of the living tissues.

"We are creatures of habit. With palates craving for new sensations, and the prevalent belief that hearty eating promotes health and strength, it is no wonder that we eat too much. It is proper, too, that the pleasure of the palate should be gratified. The pleasure which eating affords promotes digestion. Bolting does not permit proper enjoyment of food. Thorough mastication undoubtedly makes the palate more discriminating, and serves as a check to overindulgence."

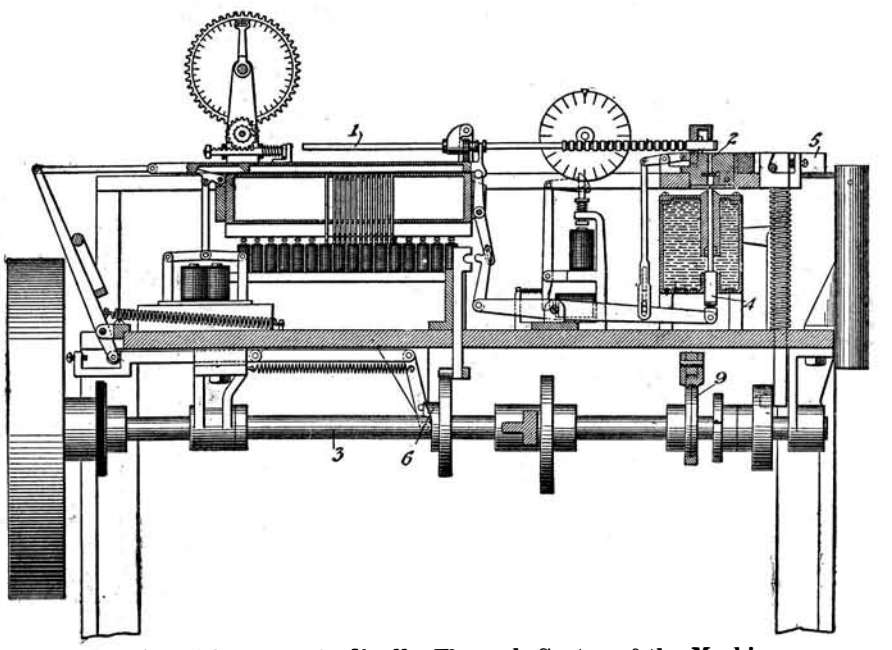
In the course of the operations for restoring the foundations to the cathedral at Winchester, England, the excavators discovered some interesting relics of the Roman occupation. Thirteen vases and lamps were unearthed. One piece was an excellent specimen of pottery, intact and in perfect preservation. The lamps are of the type known as "the lamp of learning," and resemble in shape a gravy boat with a spout at one end, from which the wick protrudes, and a handle at the other. The vessels are made of iron, and though discolored with age were perfect, and, considering their long burial, in an excellent state of preservation. As the cathedral dates from the year 1070—the early Norman period—these relics were evidently buried before the pile was contemplated, and are determined by antiquarians as belonging to the period of the last Roman occupation of Britain.

A NEW COMPOSING MACHINE.

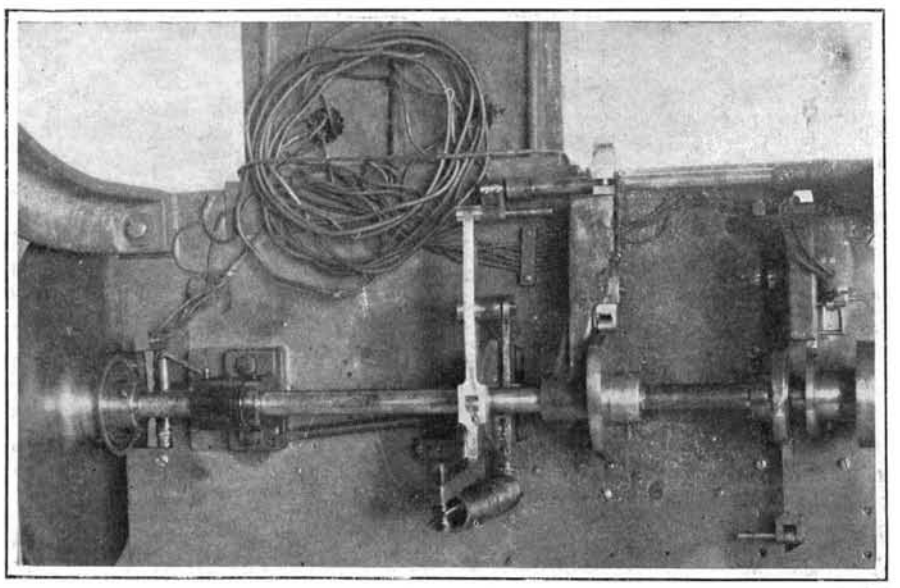
The announcement that a new typesetting and composing machine has been invented, is not calculated to arouse the interest that such an event produced fifteen years ago. Scores of composing machines have been devised in recent years, and of these only a very few have stood the test of actual practice. But the statement that a typesetting machine had been produced, which will cover a field distinctively its own, and one which has heretofore been impossible of attainment, certainly demands investigation. The machine which makes this ambitious claim is a simple bit of mechanism, but little larger than a sewing machine, as will be seen by a glance at the accompanying engravings, and the field it essays to cover is the casting and composing of advertising matter. It is well known that in advertisements, the main purpose of which is to catch the eye, certain words must be emphasized by the use of italics, full-faced type, and the like. This requires the use of a number of fonts. Some of the single-type machines at present in use are arranged to permit of a change from Roman type to italics, but for any further changes a new matrix magazine must be fitted to the machine, an operation requiring so much time that it is entirely out of the question to think of making the change for a word or even a paragraph of different-faced matter. For this reason, advertising matter is set by hand, making the cost of ad. composition disproportionately greater than that of the reading matter of a paper. The new machine intends to remedy these conditions; and in support of its claims, it may be stated that its matrix magazine comprises four different type faces, any one of which can be brought into operative position by the mere touch of a lever. Nor is the machine limited to four fonts; for it may carry six or eight different type faces without any further complication of the mechanism. And then, if desired, the matrix magazine may be removed and replaced with another of an equal number of fonts in less than two minutes. This time would include the changing of the molds to accommodate a different thickness of type body. However, even without changing his magazine, the operator has at his immediate command an ample variety of type faces, which can be introduced at will with scarce a moment's interruption. This result is effected in a remarkably simple manner. The magazine is composed of six bars of square cross section. Each bar carries on its four faces matrices of a certain unit's width, arranged in single column, and each face of a bar carries matrices of a different font. To change from one font to another, it is merely necessary to operate a lever, which turns the bars over in their bearings, so as to present the desired face to the operative position. The operation of the machine can be traced in the accompanying drawings. When a key of the keyboard is struck, it releases one of the matrix bars 1, which slides over its respective mold 2, and when the desired matrix reaches the mold, the bar is stopped by a pin selected by this key. Both the release of the bar and the raising of the stop pin is effected electrically by means of electro-magnets. As soon as the desired matrix reaches the mold, a magnetic clutch is actuated, which couples the cam shaft 3 to the driving pulley, and the casting mechanism is set in operation. The type metal is injected into the mold from the bottom by a plunger, 4. The mold is kept cool by a water jacket, so that the metal instantly hardens. The sides of the mold are then withdrawn through the open channel thus formed, and the type is pushed laterally into a word magazine, 5, at the rear. These operations are performed by a single turn of the cam shaft, which, just before completing its rotation, draws the matrix bar to its original position by means of cam 6, and breaks the circuit of the magnetic clutch disconnecting the shaft and pulley. The casting action, which from this description may seem quite complicated, is, as a matter of fact, very simple, and it takes but an instant of time. Before the operator can strike the next key of a keyboard, the whole operation is performed, and the various parts are returned to their normal positions, ready to cast another type. The word magazine is provided with a number of compartments, in which the types of each word are separately assembled. As soon as a word is completed, a key is struck which shifts the magazine to bring another compartment into line with the type ejector 7. The second word is then assembled in this compartment, after which the magazine is again shifted to receive the third word. And so the casting and setting continues until a sufficient number of words have been assembled to form a line. An automatic counter on the machine shows how many units the line still lacks of being completely filled, and indicates how wide the spaces must be between the words. The operator then touches the specified space key, and as the spaces are cast they are successively ejected from the mold and pushed with the words into the galley. The entire line is thus composed and completely justified. As it enters the galley, a latch, 8, is sprung, which throws the "follower" mechanism into engagement with a cam 9. The follower 10 pushes the line ahead just far enough to permit the next line to be assembled in the galley. When the last line has been composed a special key is touched, which causes the follower mechanism to act while the rest of the parts stand idle. The working model of the machine, from which the accompanying photographs have been taken, is somewhat crude, as viewed from a mechanical standpoint; but these are merely matters of design, and can be easily remedied. That the principles of the invention are sound and commercially practicable, is evidenced by the operation of even this crude first model. A new set of plans is being drafted for an improved machine, which will be far more compact than the present model, but no changes will be made in the general system of operation. The machine as at present constructed is composed of but 200 pieces, as against 1,800 parts in one of the most successful composing machines now in use. The simplicity of the little compositor and caster will permit of its being manufactured at a very low cost, bringing it within reach of the small jobber and the country newspaper. The inventors of this machine, Messrs. J. R. and G. A. Pearson, have thus succeeded in killing two birds with one stone; for while their original purpose was to cheapen and expedite the work of the "ad. rooms" of our large daily newspapers, they have also come to the rescue of the small printer, who cannot invest in any of the existing composing machines owing to their prohibitive price, and who has long been struggling in an unfair competition with his more prosperous neighbors. It is not the purpose of the inventors to compete with composing machines now on the market, but it is expected that the large printing houses will find the new machine a useful adjunct to their plants, and the small printers will be enabled to turn out four times as much work as has heretofore been possible with hand compositors.



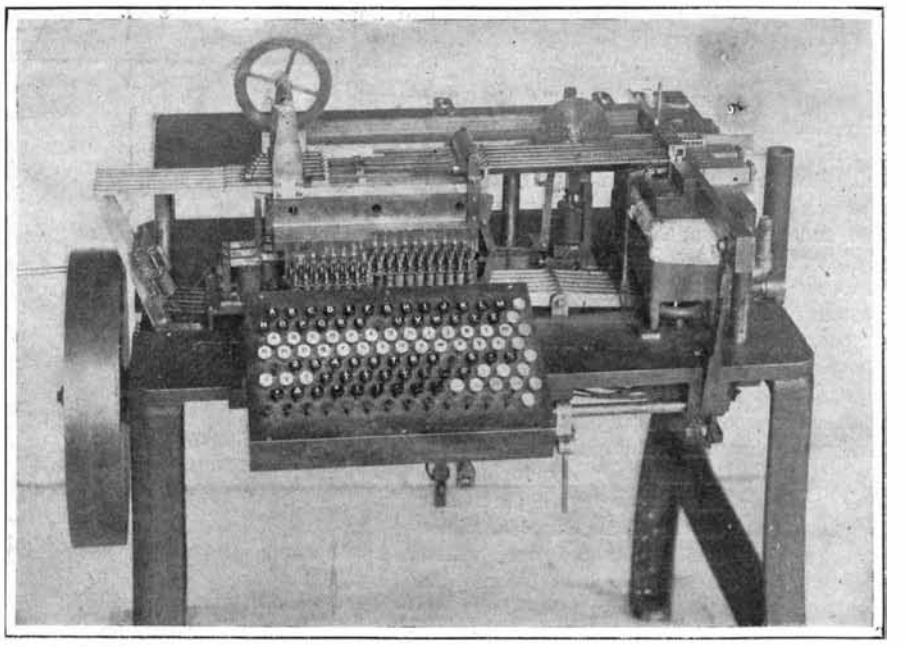
End View of the Machine.



Section Taken Longitudinally Through Center of the Machine.



View of the Underside Showing Simplicity of the Cam Shaft.



General View of the Composing Machine.

A NEW COMPOSING MACHINE.

Work is under way on the construction of 50.66 miles of second main line from Sherman, Ill., northwest to Bloomington, on the Chicago and Alton Railroad. This will, when completed, give the Chicago and Alton a double line from Chicago to Iles, 187.2 miles.

HISTORICAL PHOTOGRAPH FROM THE SEA OF JAPAN.

In the national art galleries are to be found many notable paintings depicting critical scenes in the decisive battles of the world. As these paintings were made from descriptions furnished by eye-witnesses, they are in the nature of things largely imaginative, and therefore may be no nearer the reality than the scene which is conjured up by any one who reads an account of the episode in any authentic history.

The advent of the camera, however, has made it possible for the contemporary public and all future posterity to look upon decisive events in modern warfare with the very eyes, as it were, of the participants; and the late war has furnished not a few thrilling pictures of this kind.

Unquestionably the most striking of these is the snapshot of the momentous surrender which closed the great naval battle of the Sea of Japan. Thanks to the presence of mind of the chief engineer of the Japanese battleship "Asahi," we are enabled to publish the accompanying remarkable photograph of the final act of the drama, in which the four surviving Russian ships were enveloped by twenty-seven warships under Admiral Togo. The date of this event is May 28, 1905, and the place near the Liancourt Rocks in the Sea of Japan.

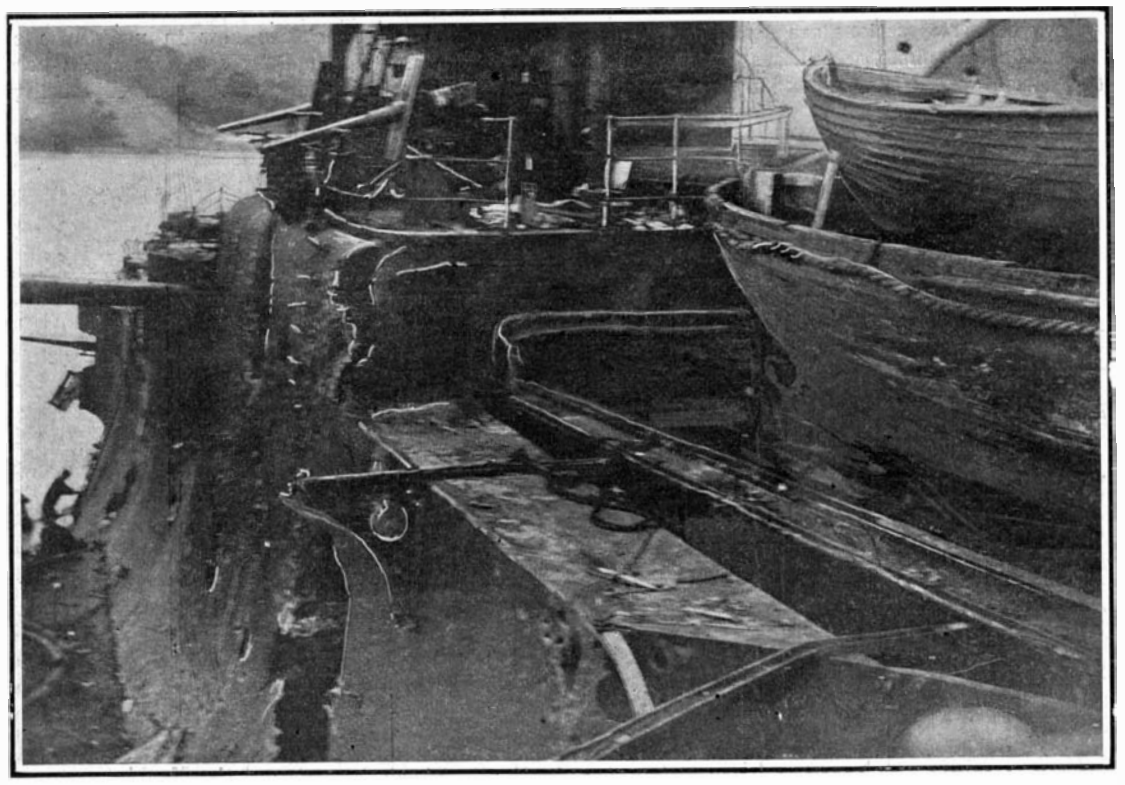
We are indebted for this historic photograph and the views of the work of high-explosive shell on the "Orel" to Mr. Saito Tsunetaro, of Tokio, who writes as follows:

To the Editor of the SCIENTIFIC AMERICAN:

Being a constant reader of your admirable magazine, it has been my fortune to know that you have always paid particular attention to the course of the Russo-Japanese war. In your articles on the war, which never failed to arouse a keen interest in your Japanese readers, you occasionally, or rather often, accompanied them with beautiful illustrations, which greatly enhanced their interesting features. Hence it has occurred to me that although the war has been brought to a close by the noble effort of your great President, yet a few accompanying photographs, relating to the last stage of its naval operations, may not be out of place in your magazine. This is the reason why I have been induced to submit them to you.

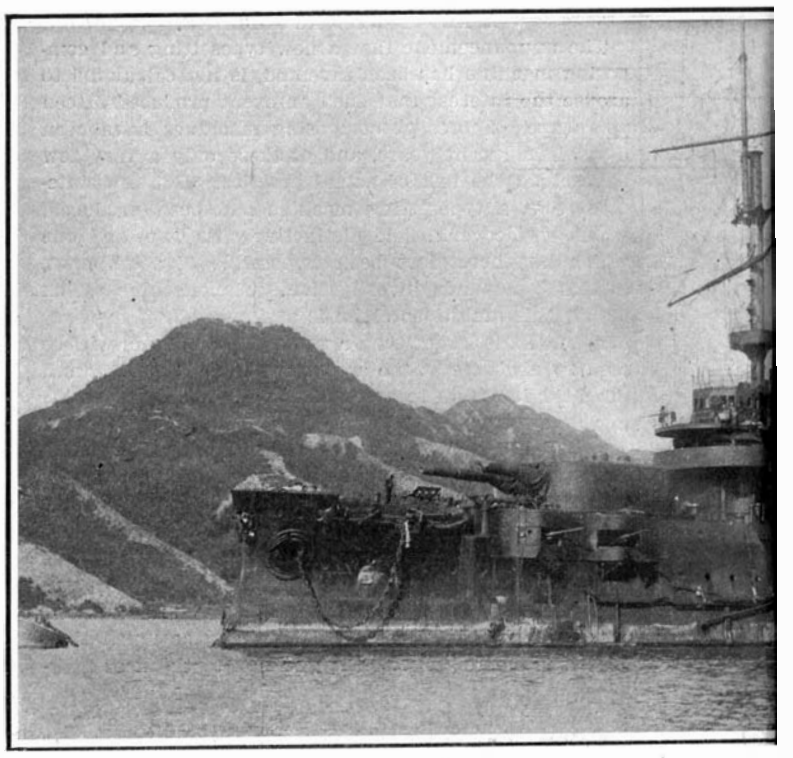
One of the photographs represents the battleship "Iwami" (formerly the "Orel") in the naval port of Maizuru. She is one of the four Russian warships that surrendered off the Liancourt Rocks on the 28th of May. She was hit by forty large shells above the water-line, and sixty smaller projectiles; while the superstructure, upper works, and upper decks are riddled by shell, steel fragments, and splinters. The port forward 12-inch gun is smashed ten feet from the muzzle by a shell. The fragment of the gun went over the bridge, smashing the rail and carrying away the breech of a 12-pounder, finally burying itself in the signal locker From the main-deck upward the condition of the ship is terrible. The steel partitions are smashed, the gangway is broken, the stanchions are wrecked, and gear of various kinds litters the decks and alley-ways.

Although the battleship "Iki" (formerly the "Nikolai I.") had her forward bridge shattered, one of the main guns in the fore-turret so much damaged as to be of no more use, and the fore port side received several shots, her general condition is not so terrible as that of the "Iwami." She took part in the great naval review with some other captured ships such as the "Sagami" ("Peresviet"), the "Tango" ("Poltava"), the "Mishima" ("Apraxine"), the "Okinoshima" ("Seniavin"), etc., on the 13th instant in the Bay of Tokio. But on the whole, the "Iki" will not make a very valuable addition to the Japanese navy, unless it is thoroughly reconstructed. One of her officers told me that it will cost a great deal to make her of any use for fighting purposes, and also to make her fit for our crew to live in. The



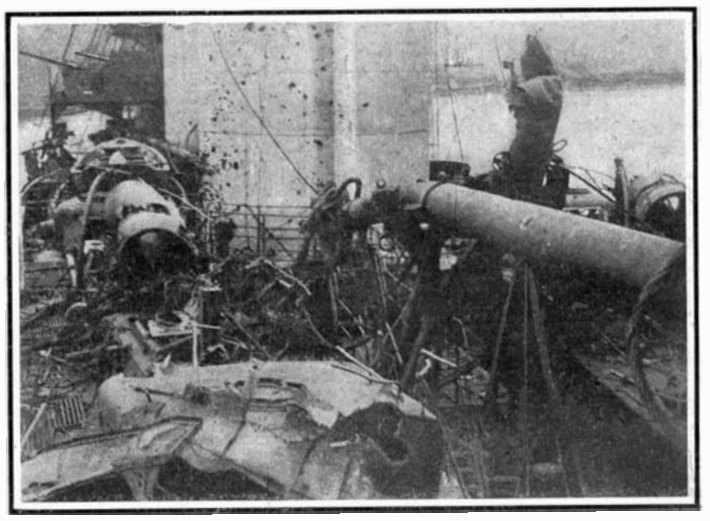
Note huge hole made by Shimose explosive shell.

Port Side and Boat Deck of the "Orel.

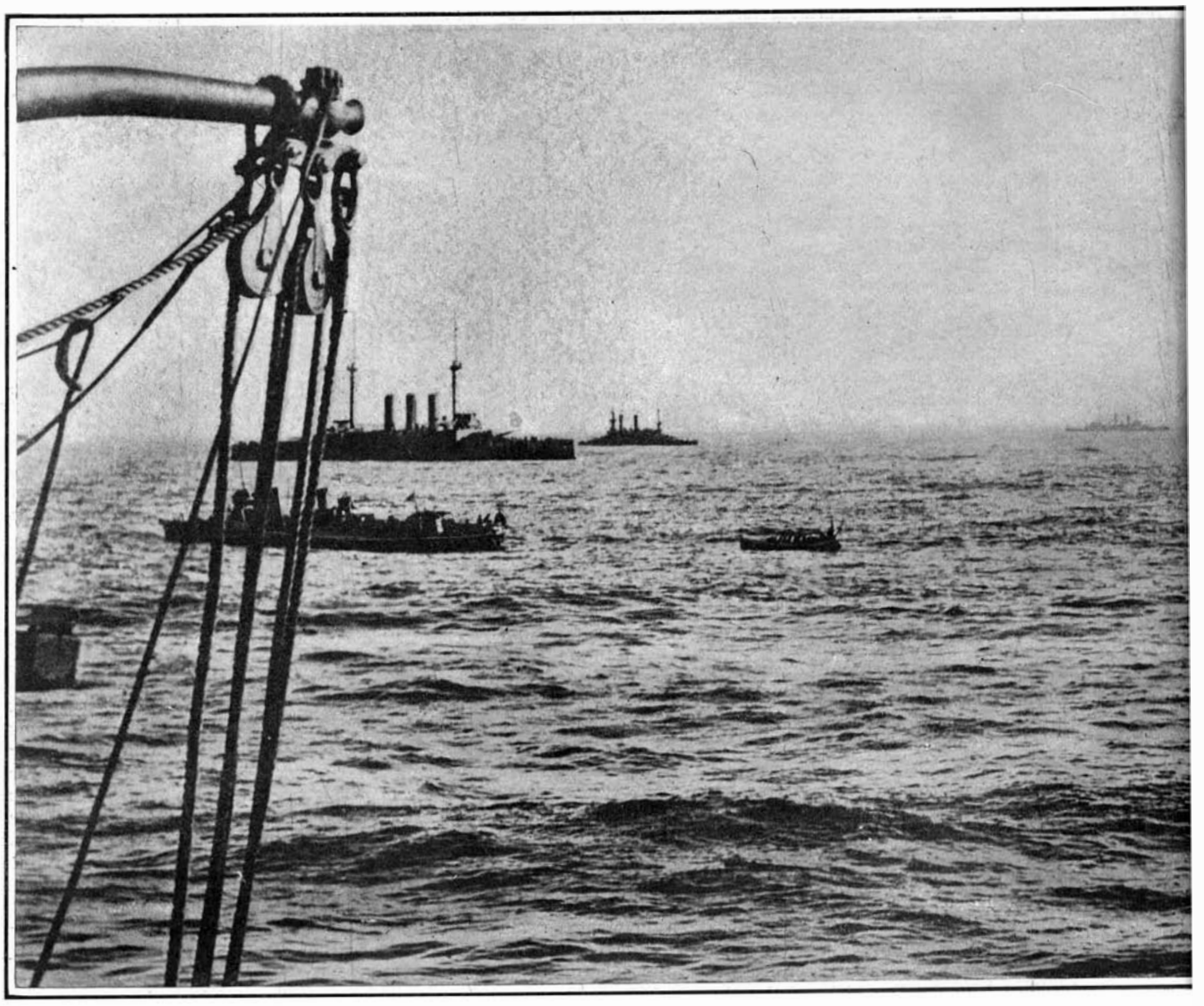


Note the broken chase of forward 12-inch rifl

Battleship "Orel" (Now the "Iwami



Wreckage on the Bridge Deck of the "Orel."



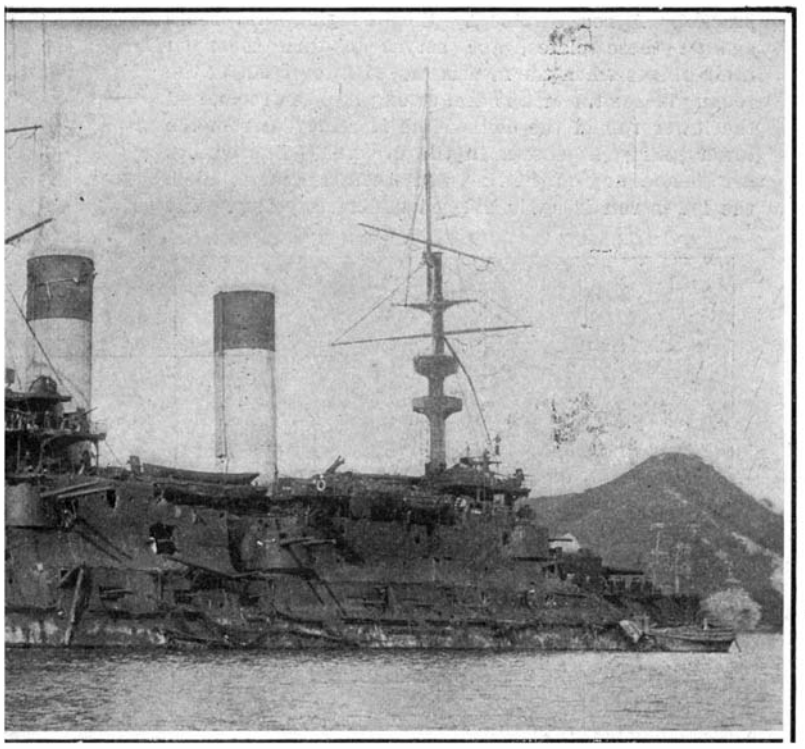
Japanese battleship "Shikishima."
Japanese destroyer "Kamome."

Russian coast-defense vessel "Apraxine"
Small boat carrying Nebogatoff to Togo.

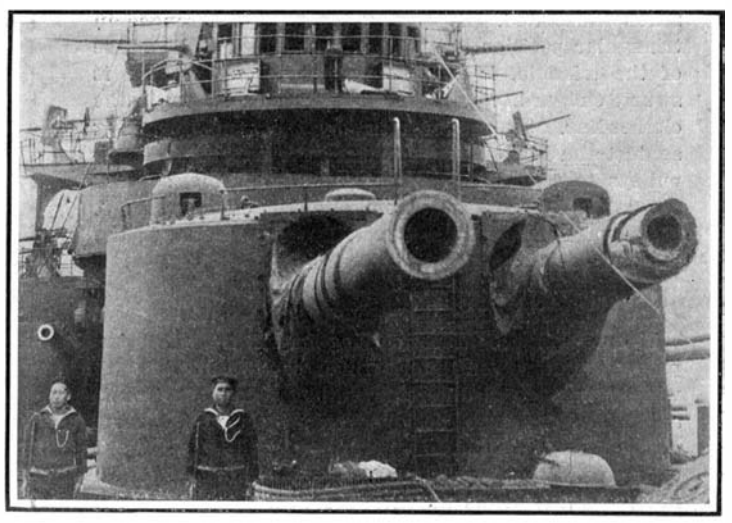
Japanese armored cruiser "

This Extraordinary Snapshot Was Taken by Chief Engineer Sehi, of the Battleship "Asahi," a Davit of Which Ves

THE FINAL SCENE IN THE



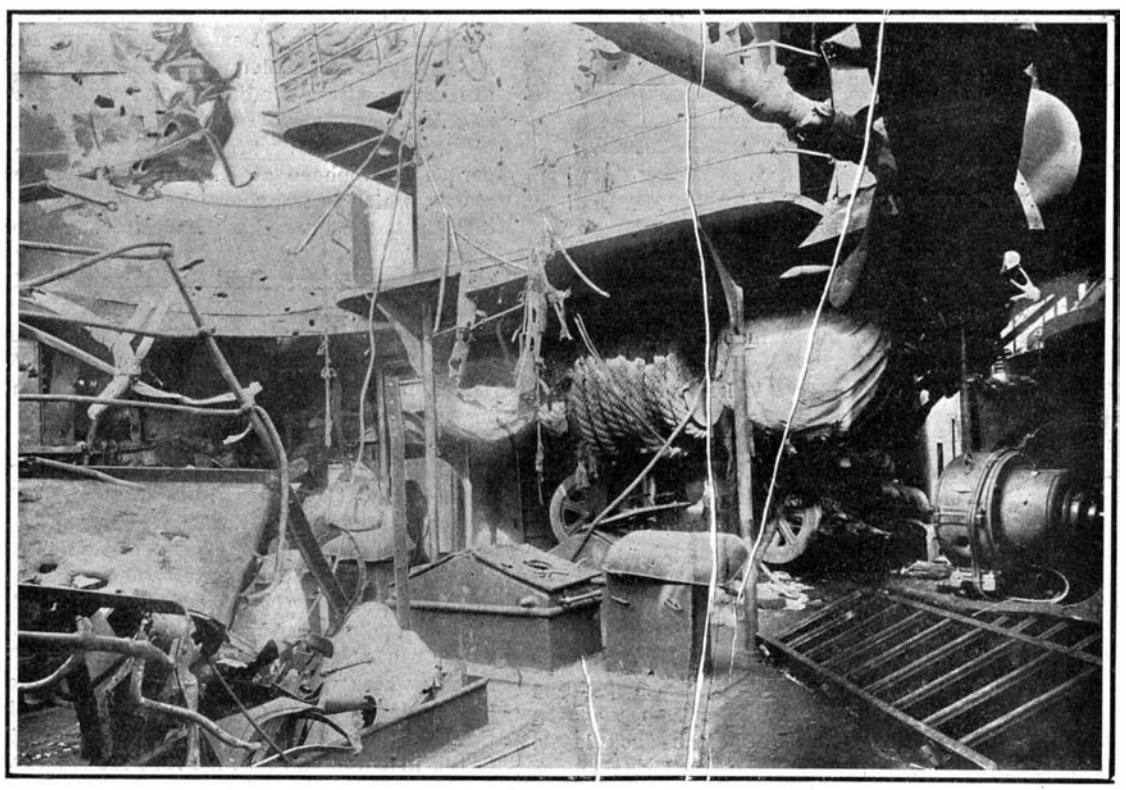
and the large holes made by high-explosive shell.
in the Japanese Naval Port of Maizuru.



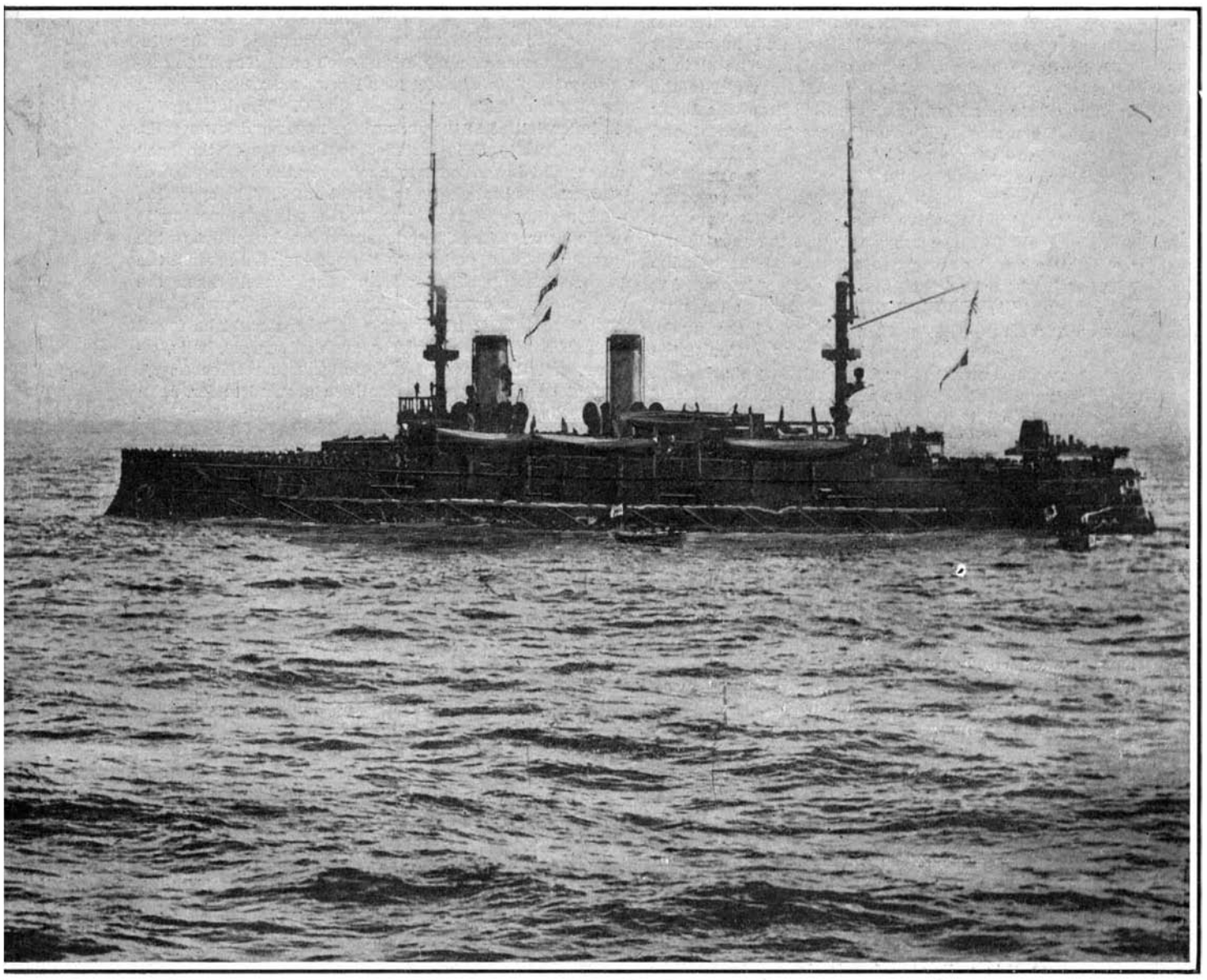
Front View of Fore Turret of "Orel," Showing 12-Inch Rifle Broken Off 10 Feet from Muzzle.

ship is remarkable for want of accommodation for the blue-jackets, while it furnishes spacious and comfortable quarters for the officers. That she had been overladen with coal is clearly demonstrated by the water-line. The photograph which represents a part of the boat-deck of the "Iwami," gives an idea of how deadly is the effect of the Shimose explosive. Another photograph gives a view of some big holes made on the port side of the "Iwami," and it also shows a part of her boat-deck. Of great interest is the photograph which gives the front view of the fore-turret of the "Iwami," showing one of her 12-inch guns smashed ten feet from the muzzle.

The largest photograph was taken at the time when Admiral Nebogatoff surrendered on the 28th of May, by Chief Engineer Seki of the "Asahi," a davit of which is visible on the left of the photograph. The first-class Japanese torpedo-boat "Kamome" is nearest to the "Asahi." Farther on to that side of the "Kamome," and almost parallel to her, is the battleship "Shikishima," with her three funnels. To the right of the "Shikishima," but farther on, is the "Apraxine." Almost in a line ahead of the "Kamome" is the small boat in which Admiral Nebogatoff and his staff are making for the "Mikasa," to confer with Admiral Togo in regard to the terms of surrender. In the middle of the picture, and fading in the distance, is the armored cruiser "Asama." The most conspicuous ship on the right of the picture is Admiral Nebogatoff's flagship "Nikolai I.," from the mainmast of which is fluttering the signal of surrender. As this was not noticed at first by the Japanese, the Russian sailors hoisted the ensign of the Rising Sun over that of Russia on the mainmast. Over the stern of the "Nikolai I." is seen the Japanese torpedo-destroyer "Shinonome." This picture is, therefore, to be looked upon as an integral part of the scene where the four Russian ships, the "Orel," the "Nikolai I.," the "Apraxine," and the "Seniavin," were enveloped by twenty-seven



View on Upper Deck of the "Orel," Showing Wrecked Gangways, Ladders and Boats.



Asama."

Admiral Nebogatoff's flagship "Nikolai I." with Japanese ensign flying over that of Russia from the gaff in token of surrender.
Japanese destroyer "Shinonome."

el is Seen at the Lett of the Picture, as Admiral Nebogatoff Was Proceeding to the "Mikasa" to Arrange Surrender.
ATTLE OF THE SEA OF JAPAN.

Japanese warships under Admiral Togo.

SAITO TSUNETARO.

The Imperial Fisheries Institute, Etchujima, Tokio, November 18, 1905.

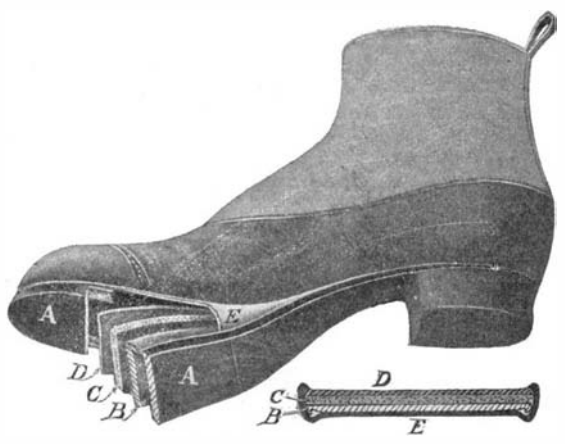
Turbine Blades.

In a paper on the construction of turbines read to the Institution of Engineers and Shipbuilders in Scotland recently by Mr. E. M. Speakman, it was stated that the material of which blades are usually made is a mixture of cheap brass containing 16 per cent of copper and 3 per cent of tin. Alloys containing zinc are extremely unreliable for high temperatures, but blades containing about 98 per cent of copper have been found very satisfactory for use with high superheats. More recently a material containing about 80 per cent of copper and 20 per cent of nickel has been adopted, and this is undoubtedly the best blading material existing. Steel blading, drawn in the same way as the usual brass section, has been used in the United States with fairly good results. The process of drawing turbine blades gives an extremely tough skin to the metal used, not only increasing the tensile strength, but greatly decreasing the chances of erosion. It seems probable that the usual calking piece now adopted will be discarded in favor of a machine-divided strip into which the blades may be fitted and instead of the slotting, wiring, lacing and soldering process at the tip, a similar machine-divided shroud will be used. This will give a far stronger construction and will enable finer clearances and better workmanship to be obtained, at the same time considerably reducing the cost of manufacture and the risk of blade stripping. The chief causes of the latter may be set down to bad workmanship in fixing the blades, defective blade material, excessive cylinder distortion—this probably the most fruitful cause and a serious one, being due to bad design—whipping of turbine spindles (also due to bad design or bad balancing), wear of bearings, which is very remote, and the introduction of extraneous substances such as

water or grit. In fact, blade stripping may be said to occur generally from preventable causes. Small vibrations of very high frequency occasionally set up an action in certain rows of responsive length that fatigue the blade material and cause the loss of blades without any fouling at all.

IMPROVED CUSHION SOLE FOR SHOES.

Pictured in the accompanying engraving is an improved cushion sole for shoes which avoids the prin-

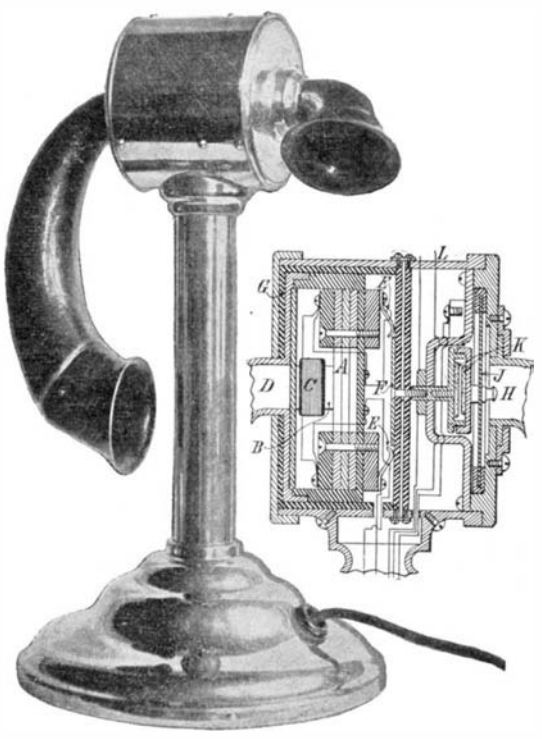


IMPROVED CUSHION SOLE FOR SHOES.

cipal faults of cushion soles as heretofore made, namely, the wrinkling or puckering of the sock lining along the edges, or the forming of troublesome seams. At the same time all the valuable features of a cushion sole shoe are preserved. Dampness does not penetrate the sole, and the foot is kept perfectly dry, thus preventing colds, pneumonia, and kindred sicknesses. The sole also yields to the various movements of the foot, giving a soft, comfortable tread, reducing friction, and thus effecting a saving of the stockings, as the surface on which the foot rests is perfectly smooth, owing to the very ingenious process by which the cushion sole is made. The improved sole comprises a sock lining, consisting of an upper layer of duck and a lower layer of leather cut to the shape of a shoe sole and sewed along their edges. The duck layer is slit along the center line and the sock lining turned inside out so that the leather layer, *D*, is uppermost and the duck layer, *E*, laps under with the seams turned inside. A cushion sole, *C*, and an insole, *B*, with the usual lipped or channeled edge, are slipped in between the layers *D* and *E*, as shown in the cross-section view. The welt and the upper are now sewed to the insole through the layer *E*, thus securing the sock lining to the shoe. The lining, *E*, is raised to allow the stitches to be located in the channel at the insole. The channel flap is then trimmed in the usual way, cutting off the surplus portion of the lining, *E*, after which the outsole, *A*, is secured to the welt. The Cummings Company, of Worcester and Boston, Mass., owns the patent on the process of making the sole.

AN IMPROVED FORM OF TELEPHONE INSTRUMENT.

A great fault of the telephone as commonly constructed is the fact that one must hold the receiver to the ear with the hand, thus interfering with one's freedom and hampering the taking of notes, jotting down memoranda, etc. Furthermore, if the conversation is long, or if there is any material delay in making connections, as in long-distance communication, it becomes very tiresome to hold the receiver to the ear. In the accompanying engraving we illustrate a telephone instrument of improved construction, which aims to overcome these objectionable features. Both the transmitter and the receiver are combined in a single instrument, the receiver being provided with a horn that can be brought to operative position against the ear, in which position it will remain without being held by the hand. The act of raising the horn connects the instrument with the line circuit. Our engraving shows a section through the upper part or head of the instrument. At *A* is a permanent composite magnet which carries a core *B*. On the latter is the coil *C*, which operates the receiving diaphragm. The receiving horn is secured to a shell in which the magnet is incased. A pair of contact fingers *E* are carried by the shell. When the horn is swung up to the receiving position the shell is turned, bringing the fingers into contact with the plate *F*, and thereby completing the electrical circuit of the coil *C*. To prevent vibration of any sort from affecting the receiver, the entire shell which carries the magnet and diaphragm is inclosed in a casing of soft rubber *G*. This is particularly important in long-distance instruments, which are very delicately adjusted and are affected by the slightest vibrations. The mouthpiece of the transmitter is shown at *H*, with the diaphragm at *J*, and the carbon microphone at *K*. The wires *L* lead to the ringer, which is not shown here, but may be attached directly to the instrument, if desired. The mouthpiece *H* may be turned to any angle to suit the convenience of the user. The principal advantage of the instrument will be found in the fact that it is not necessary to apply the ear directly to the receiving horn; for the latter, owing to its form, concentrates the sound waves, projecting them in a single direction. In calling up a number one need merely remain in the vicinity of the horn, and after the connection has been made he may carry on a conversation over the telephone without holding his head at any set position, and with his hands perfectly free to handle papers or take down notes. If the conversation is private, he may apply his ear directly to the horn. The outer end of the horn, it may be observed, is formed with a swiveled section, which will adjust itself closely against the ear. Owing to the use of a horn, that muffling of the sounds which results when a receiver of the ordinary type is held tightly against the ear, is avoided. Mr. S. P. Levenberg, 4388 Park Avenue, New York city, is the inventor of this improved instrument.



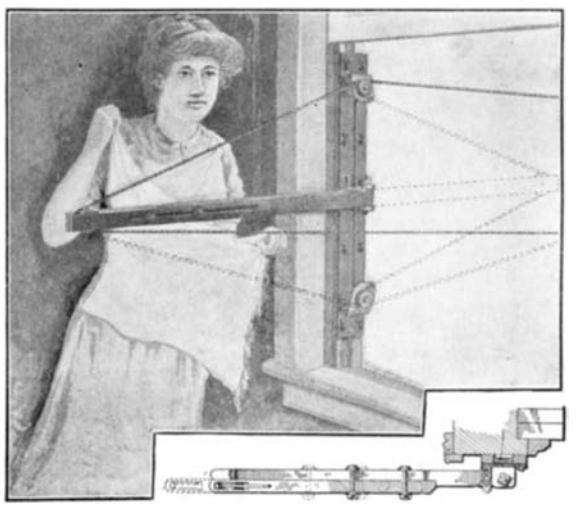
AN IMPROVED TELEPHONE INSTRUMENT.

Brief Notes Concerning Patents.

The invention of a means for preventing the habit of snoring appears ingeniously handled in a recent device which consists of a flexible plate or mouthpiece adapted to be held between the lips and in contact with the teeth and gums when sleeping. The plate is provided with a check-valve adjusted to regulate the amount of air admitted to or expelled from the lungs through the mouth. The mouthpiece is elliptical and conformable to the shape of the mouth, and is formed of rubber, canvas or cloth. The plate is furnished with a flap-valve, which normally closes an opening formed therein, the valve being adapted to prevent ingress of air into the lungs through the mouth and to permit a small quantity to be expelled through the opening in the act of exhaling. By the valve opening outwardly air is compelled to enter through the nose passages, thereby preventing vibration of the uvula. If for any cause nose breathing is too difficult, the plate may be reversed, thereby admitting air, but an amount insufficient to cause vibration. The device if successful in obviating harsh nasal sounds, will be credited also with keeping the mouth from becoming dry and parched, cleansing the nasal passages and maintaining proper purification of air and its correct temperature. Mouth breathing entails a loss of forty per cent of that warmth so highly essential to the lungs.

CLOTHES-LINE SUPPORT.

An improved clothes-line support has just been invented which is so arranged as to permit a person to hang clothes without having to reach out of the window. The device, which is conveniently attached to the window frame, is swung into the room while the clothes are being hung on or removed from the line, after which the support may be swung out of the window, permitting the latter to be closed. The invention comprises a bracket formed with bayonet slots, which engage screws in the window frame. It can thus be readily removed or applied, as desired. Pivoted on this bracket, at the center, is an arm which swings horizontally. The arm is preferably formed of two pieces, which are adjustably secured so that the device may be extended, as desired. A pulley is mounted at the outer end of the arm, and the clothes-line passes over this pulley, and extends out to another pulley on a post or other suitable support arranged in the yard. The clothes-line also passes over two pulleys journaled on plates, which are hinged to the main bracket. A rod carried by the swinging arm bears against these plates, and serves to turn them on their hinges when the arm is moved into or out of the room. In use the arm is first swung into the room, and the lower run of the clothes-line is removed from the lower pulley, as shown in the drawing. The clothes are then strung on the line, and when the line is filled, the lower run is again slipped under its pulley. The

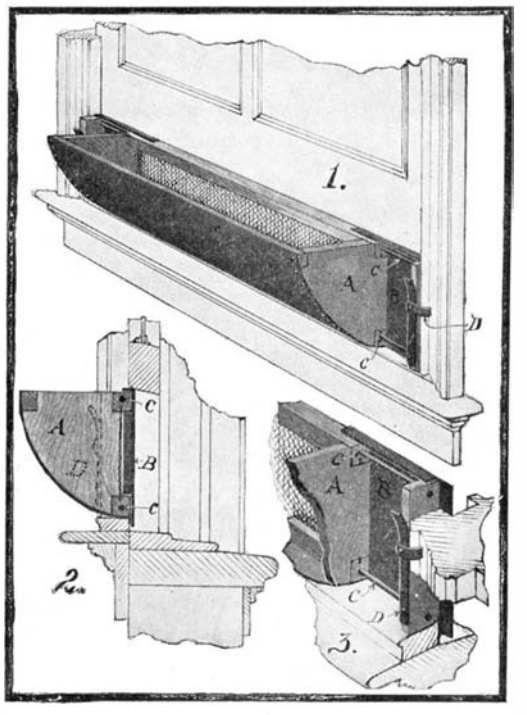


CLOTHES-LINE SUPPORT.

arm is now swung out of the window to the dotted position illustrated. By having the pulleys arranged in triangular position, with the arm pivoted in the base of the triangle, it is evident that when the arm is swung outward, very little, if any, slack occurs in the clothes-line. The rod carried by the arm, by acting against the hinged plates, causes the upper and lower pulleys to follow the pull of the clothes-line, so that the latter is prevented from slipping off. Mr. P. J. Sloan, of 19 West 10th Street, Bayonne, N. J., is the inventor of this improved clothes-line support.

ADJUSTABLE WINDOW VENTILATOR.

Pictured in the accompanying engraving is an improved window ventilator, which can be adjusted to window casings of different widths. The ventilator is a box-like structure, designed to project into a room from underneath the lower window sash. The frame of the ventilator consists of two end boards, as shown at *A*, and three rails which connect these boards at the corners. A strip of sheet metal nailed to the frame forms a curved front wall. The rear side of the frame is covered with a wire screen, and the upper side is left open. Drain holes are drilled in the lower rail to permit escape of any water that may enter the ventilator. The ventilator is made adjustable to the window by means of a slide *B* at each end. The slide consists of a plate of sheet metal provided with a wooden head piece which carries the pins *C*. The latter slide in holes drilled in the ends of the upper and lower rails. A spring clip *D* is fastened to the edge of the head piece, and is designed to hook over the inner edge of the jamb, as best shown in Figs. 1 and 3. The operation of inserting the ventilator in the window opening is quite clear. The sliding members are drawn out to the proper distance, and the ventilator inserted against the sash, with the clips engaging the jambs. Then the sash is drawn down until it meets the upper rail of the ventilator. This improved ventilator should be found valuable in all public places, such as schools, halls, offices, and the like, and also in private residences. A patent on this invention has been granted to Mr. John L. Meeks, 367 Tompkins Avenue, Brooklyn, New York.



ADJUSTABLE WINDOW VENTILATOR.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

AUTOMATIC ELECTRICAL CONTROLLER FOR AIR-COMPRESSOR.—F. D. ACKERMAN, Kendallville, Ind. This apparatus arrests automatically the operation of an air-pump when a certain desired pressure has been attained in a storage-tank with which the pump is connected. The invention is particularly intended and adapted for use in connection with the air-pump and air-storage tank employed in trolley-cars for braking and signal purposes, but is capable of general application and use.

RINGER FOR TELEPHONES AND THE LIKE.—E. R. HOBBS, Lamar, Col. The invention is of particular value on telephone-lines. The purpose is to produce a more efficient type of ringer provided with various adjustments and admitting of a number of distinct uses. By combinations of adjustments the armature can be made to assume an indefinite variety of positions relative to the magnet, and therefore serves to greatly increase the utility of the ringer when employed in various kinds of telephony and for purposes independent thereof.

ELECTRIC WATER-METER.—R. H. MILTON, Reidsville, N. C. The object of this improvement is to provide a meter in which all the registers of the various water-takers may be assembled at one central station, and under the supervision, inspection, and control of the water company or municipal government, while the register-actuating devices shall be on the premises of the water-takers.

ANNUNCIATOR.—J. PATTEN and W. PATTEN, New York, N. Y. The invention relates to an annunciator or indicating device, the indicating parts of which are operated through the agency of solenoid-magnets. Preferably the inventors provide a plurality of solenoid-magnets, the cores of which are connected with the indicating devices, and they arrange circuit-making devices in connection with the magnet so as to cause the core and attached indicating device to take either one of three distinct positions.

LIGHTNING-ARRESTER.—E. S. MOORER, Anderson, S. C. If on the ground-plate being permanently connected with the ground-wire, an electric charge of unusual tension energizes either service-wire, the high-tension electricity enters the office by way of the service wire and immediately leaps across from the bare wire to one or more teeth of the plate. For this purpose the adjacent bends of the bare wire are in juxtaposition with the teeth upon the principle that lightning tends to leap from points to points. If high-potential and high-frequency electricity is prevented leaping from the bare wire to the plate, and therefore tends to reach the instrument, the discharge-plate is magnetized, which tends to retard the flow of electricity of high potential and high frequency, so that tendency of the latter to leap over to the ground plate is greatly increased.

Of Interest to Farmers.

TRAP-NEST FOR LAYING HENS.—C. B. WILLIAMS, Ontario, Cal. This novel trap-nest will freely admit a hen to the nest, hold her confined as long as is necessary, and upon leaving the nest admit the hen to an adjoining compartment, automatically close a door between this compartment and the nest and confine the hen until removed by an attendant, thus preventing her from eating the egg, if one is laid, and by tagging her test the laying capacity of individual hens and of the strain of fowls that the trapped one represents.

PEANUT-PICKER.—F. F. FERGUSON and J. T. BENTHALL, Murfreesboro, N. C. In harvesting peanuts the vines, with the nuts adhering in clusters, are plowed out of the ground, shaken free of the dirt, and then stacked up. This machine is designed to take these vines, with their nuts hanging to them, and to pick off the nuts and clean them ready for bagging, while the vines are discharged over the end of the machine in condition to be utilized for cattle-feed.

Of General Interest.

CLAMP FOR WIRE-STRETCHERS.—D. H. PARKER, Boston, Ga. The object of the inventor is to provide a clamp for application to mesh or woven wire fabrics or fencing, whereby a firm connection can be had between any ordinary stretcher or tension device and the fencing. He provides an adjustable device, so as to accommodate the same to different styles of fencing and to wires of different sizes and heights of fencing. Also means for connecting the clamp to the fencing and permitting of rapid and convenient removal of the device.

BASE FOR GARMENT-FORMS.—E. T. PALMENBERG, New York, N. Y. The object in this invention is to provide an improved base for garment-forms having feet displaying footwear and stockings and arranged to permit convenient forward and backward adjustment of the feet to show more or less of the footwear, according to the dress displayed on the form, and to allow convenient tilting of the form, according to the style of dress to be displayed.

CIGAR-PIERCER.—C. PINTZ, Budweis, Austria-Hungary. This invention relates to improvements in piercers of the kind described in the specification of British Letters Patent No. 6958. According to the present invention the piercer in addition to the two tubular members normally held extended by a spring as before, comprises a slotted tubular cutter, fixed within the rear end of the inner member and fitted to slide through a guide-hole in the neck of the bell mouth, and a short core-ejector integral with a lug passing through the slot in the cutter and through a lateral aperture in the outer member of the casing, whereby the ejector is fixed.

COMBINED KEY AND LIGHTING DEVICE.—J. L. SCANLAN, Indianapolis, Ind. It is frequently difficult to locate the small keyhole for a night-latch. One of the objects of this invention is to so combine the key of a night-latch or lock with a lighting device that an adjustment of the key preparatory to its use will automatically furnish a light adjacent to the key, so that the keyhole may be readily found and the key inserted therein.

STEAM-GENERATOR.—P. STOLTZ, Berlin, Germany. In the present invention the superheater-tubes are mounted in vertical groups between the sections or plates and are distributed in the same manner as the tubular sections. By this means important advantages are obtained both as regards the operation of the superheater and also of the steam-generator, which is composed of the plate elements.

POSITION-FINDER.—H. S. CLARK, Onehunga, New Zealand. This finder is particularly for use for coastwise vessels, yachts, and vessels in sight of fixed objects, and it can also be used for recording positions on land, the purpose of the invention being to provide a position-finder of simple and inexpensive construction, having no parts liable to get out of order, and requiring no special skill to operate it.

ATTACHMENT FOR FOOTWEAR.—H. C. BOICE, Hanford, Cal. This improvement has reference more especially to attachments for footwear and is applicable alike to all forms thereof, such as shoes, boots, gaiters, leggings, and the like, or such as are ordinarily denominated in the trade as "full-top" or "high-top" in contradistinction to the "lowquarter" type, and such also as are formed with an opening therein either at front or side, along or adjacent to the edges of which are disposed eyelets or hooks for receiving and engaging the usual lacing-cord for the article.

SIGNAL.—R. STANFORD and P. R. COLPITT, Halifax, Nova Scotia, Canada. The invention relates to a "flare-up" or pyrotechnic signal designed for marine or other uses, and it resides particularly in the special devices for protecting the illuminant and firing the same at the time desired. The color and intensity of the signal will depend upon the character of the illuminant employed.

DEVICE FOR CALCULATING HORSE-POWER.—E. MCC. SCOVILLE, Waipahu, Hawaii. This invention refers to a planimeter, in combination with a support therefor especially adapted for the operation of the planimeter and provided with a new and improved slide rule, particularly designed for calculating horse-power. The principal object is to provide means for calculating horse-power from an indicator-card accurately, conveniently, and rapidly.

BOTTLE-SEAL.—A. E. PRIER, New York, N. Y. The aim of this inventor is to provide a sealing device that will prevent uncorking without first breaking the seal, and thus destroying the identity of a bottle as an original package, or, in other words, assuring the purchaser of a filled bottle when the seal is intact that the bottle contains the material first placed therein, thus protecting the purchaser and packer from fraud.

MANUFACTURE OF SAND-LIME BRICKS.—A. GORDON, Weiser, Idaho. The invention relates to the manufacture of bricks, and is especially applicable to the hardening of sand-lime bricks. The principal object is to overcome former difficulties by providing a hardening method that will permit the molding of bricks in a moister state, so as to take full advantage of the plasticity inherent in materials employed, and furthermore to use the pallet system of molding and hardening.

GATE-VALVE.—H. MILLHOLLAND, Reading, Pa. The invention is an improvement in gate-valves, and particularly in that class having rotative parallel disks operated by wedges or spreading devices. Among the objects are to provide a novel construction whereby the main or body wedge-block supports all the movable parts and whereby the thickness of the valve is reduced to a minimum, thus reducing the weight and amount of material necessary for the construction of the valve to the minimum and incidentally reducing to the minimum the weight of the valve-casing by reducing the distance between its opposite valve-seats.

Heating and Lighting.

GRATE.—W. C. ENGEL, Fountain Springs, Pa. One purpose of the invention is to provide a grate made in two or more sections, each section being individually operated, so that the live coals from one section may be transferred to the adjoining section and the dead coals dumped from the first-named section and the live coals again placed on the section dumped and restored to its normal position, while the other section may then be dumped, and thus the grate be entirely cleaned and a new bed be placed on the live coals for kindling.

HOT-WATER-CIRCULATING APPARATUS.—A. B. RECK, Copenhagen, Denmark. This invention pertains to hot-water heating apparatus of that class in which steam is introduced directly into the water to be heated. The object is the construction of an apparatus in which a very economical operation and exact regulation can be obtained by the same low steam-pressure that is now used in common house-heating steam-boilers.

Household Utilities.

CHAIR.—H. H. HOOVER, Fort Smith, Ark. Mr. Smith's invention relates to that class of chair known as "knockdown." His object is to provide a chair which shall not only be simple in construction, more rigid, and of greater strength than any similar chair known to him, but be adapted in conformation of parts for quick and secure assembling thereof. He provides a knockdown chair having improved strength and rigidity with novel supporting and securing means substantially removed from sight on the finished article.

Machines and Mechanical Devices.

AUTOMATIC FEED MECHANISM FOR PRINTING-PRESSES.—G. G. WILLIAMS, Shreveport, La. Means are here provided whereby the feeding of the press of the ordinary platen-and-bed type may be effected automatically instead of by hand, thereby dispensing with an attendant upon the press and enabling the press to be driven by steam or other motive power. Means are provided whereby a press of the ordinary hand-fed platen-and-bed type may be readily converted into an automatically-fed press without removing or disconnecting any parts or preventing reconversion of press into its first or original form.

TABULATING ATTACHMENT FOR TYPE-WRITERS.—J. C. WOLFE, New York, N. Y., and E. C. MORTON, Whiteplains, N. Y. The object of the invention is to provide a readily-operated mechanism whereby the carriage may be instantly moved from any fraction of a division on a scale to a fraction of another division on said scale, either up or down the scale, and whereby the carriage may be moved the distance of a full division of the scale at one manipulation of a key, or whereby the carriage may be made to move its full length if necessary.

COFFEE-HOPPER.—G. W. PHILLIPS, Mianus, Conn. In this patent the improvement has reference to coffee-hoppers; and the object of the invention is the production of a hopper adapted to contain coffees of different kinds and provided with means for mixing them in various proportions and at the same time weighing the mixture.

ROAD-SCRAPER.—V. M. JACKSON, Laurel Hill, La. This invention relates to power-drawn scrapers employed for the leveling of material in the formation of a new road-bed or the repair of a road, as occasion may require. This scraper with two horses, following immediately behind an ordinary turn plow will remove all the ground broken by the plow to that part of the road desired by the driver of the team and in this way can work several miles of road per day at a nominal expense.

ELEVATOR AND CONVEYER.—A. G. EDMUND, Vicksburg, Miss. This invention is an improvement in elevators and conveyers particularly adapted for loading and unloading steamboats, barges, and other craft. The apparatus may be extended at a greater or less distance in either direction for loading or unloading at different distances from a central point. It is applicable not only for operations with relation to a wharf, but sections may be extended up or along a river bank where freight is loaded or unloaded from a sloping bank. It may be applied equally as well on land alone in connection with elevators, storehouses, etc., for loading or unloading, kegs, barrels, boxes, cotton bales, or bags and lumber.

DIFFERENTIAL GEAR.—R. H. BROCKMAN, New York, N. Y. This invention relates to gearing by means of which two independently-revoluble members may be uniformly driven and at the same time allowed a differential turning movement. It resides primarily in the connection of the driving member with the driven members through the medium of a belt as contradistinguished from the toothed gears hereinbefore employed. Preferably this belt is of the chain type and coacts with sprockets mounted on the driving and driven members. It is especially adapted for motor-vehicles, but may be used in other connections.

DRIER.—J. W. BILES, Louisville, Ky. In this instance the improvement refers to driers, and more particularly to means for applying heat thereto. Its principal objects are to provide an air conduit which will uniformly distribute the heat to the drying-chamber without danger of scorching the material operated upon and which may be readily repaired, if necessary.

PLATE-PRESS.—R. TURNER, New Canaan, Conn., and B. R. CORLEY, New York, N. Y. The object of the present invention is to provide a plate-press arranged to allow of running the press at a high rate of speed without undue shock or jar, especially on the starting of the impression-roller and the bed or table and also when they come automatically to a stop after the impression is made. It relates to plate-presses for copper and steel plate printing, and such, for instance, as shown and described in the Letters Patent of the United States formerly granted to Messrs. Turner and Corley.

DRILL-FEED.—J. G. WINGER, Grand Valley, Pa. This new drill-feed is especially useful in connection with drills employed for driving wells—such as oil, gas, and artesian wells—in which the drill is connected by a rope with means for alternately raising and lowering the drills, and devices are provided by which the rope may be gradually lengthened as the drill sinks in the shaft. By means of this invention the drill may be raised by hydraulic action and gradually lowered, the latter operation requiring no exertion whatever.

ELECTRIC STOP-MOTION FOR KNITTING-MACHINES.—A. L. PATTERSON, Albemarle, N. C. The present device is an improvement upon the one shown and described in a previous patent granted to Mr. Patterson. It consists in the improved construction and arrangement of the movable parts operated upon by the yarn and also in the provision for applying the device to that form of knitting-machine which carries its yarn-bobbins on a revolving frame above the knitting-machine.

WASHING-MACHINE.—W. C. DYKE and W. J. ALDERMAN, Walla Walla, Wash. The object of this invention is to provide a locking mechanism so arranged that the brake can be moved into holding position by the turning of the apron into the space between the rotary clothing-cylinder and the outer casing, thus preventing the turning of the cylinder while clothing is being placed therein or removed therefrom, thus obviating possible accidents to machinery or handlers of goods. It relates particularly to steam washing-machines.

WASHING-MACHINE.—C. E. GOULDING, Bluffsprings, Fla. The invention has reference more especially to washing-machines of the pounder type. One object is to provide the machine with means whereby the material of the garments to be cleansed is prevented from sticking to any part of the machine or pulling out therewith when the machine is lifted from the cleansing-water at the end of each operative stroke imparted thereto.

Prime Movers and Their Accessories.

HOT-WATER DISTRIBUTER FOR STEAM-GENERATORS.—I. L. WILSON, Alberta, La. Water is usually fed into steam boilers or generators at a single place, whereby the adjacent portion of the same is cooled or less heated than others, so that unequal expansion results, with consequent injury to the boiler or generator. Mr. Wilson has devised and applied an improvement in that class of attachments whereby the feed-water is divided and distributed and delivered in uniform quantity at a series of places, so that the expansion is equalized and other advantages obtained.

STARTING MEANS FOR GAS OR SIMILAR ENGINES.—F. L. ORR, Thurman, Ohio. This improvement relates to means for facilitating the starting of gas, gasoline, or similar engines, and has for its object means for the purpose stated wherein are employed electrical circuits having therein cut-outs and closers, a compressed-air chamber, and an air-passage leading from the chamber through a carbureter and thence into the explosion end of one or more working cylinders of the engine. Igniters are located in the cylinders, having arrangement in the electrical circuit for ignition of the explosive charge in the cylinders through completion of electric circuit by novel means and circuit-wiring.

INTERNAL-COMBUSTION ENGINE.—T. WRIGHT, Jersey City, N. J. The invention relates to an engine of the type in which a plurality of cylinders are arranged to swing around a stationary cranked shaft, the movements of the engine being taken from a part connected to move with the cylinders. The leading feature resides in the arrangement of a number of pump-cylinders alternately with the power-cylinders and in providing valve-controlled communications between each pump-cylinder and the two adjacent power-cylinders.

ELASTIC-FLUID TURBINE.—M. A. GREEN, Philadelphia, Pa. This economic slow-speed engine utilizes the power of steam admitted to it to a very high degree, is especially adapted to avoid loss of power through leakage, and provides for so distributing the impulses which actuate the turbine as to balance the wheel in all directions. The principal feature is to construct a turbine with one wheel only and produce the same or better results than other types of turbines using from six to eight. Most types of turbine-engines use many wheels, so as to expand the steam and are compelled to use many in getting required efficiency, for the reason that they only use a small portion of each wheel.

PISTON-ROD PACKING.—C. L. COOK, Louisville, Ky. This invention pertains to improvements in packing devices for piston-rods or the like, the object being to provide a rod-packing having a triple-cone ring in the combination, thus giving to the ring a greater volume of metal, and therefore greater strength than would be possible in a ring having a continuous taper from its bore to its periphery.

ELASTIC-FLUID TURBINE.—H. G. WOOD and H. BURLINGHAM, Newport, R. I. An object of this invention is to provide a turbine useful particularly in connection with steam and in which the kinetic energy of the motive fluid will be maintained as high as possible throughout its movement through the turbine. Another is to so distribute the motive fluid in the turbine as to secure the full benefit of the motive force and to equalize as fully as possi-

ble the strains on the apparatus. The inventor improves speed regulation of rotating parts by providing devices for throttling the motive-fluid supply.

Railways and Their Accessories.

CAR-SEAT.—F. BENNETT and S. A. WALKER, New York, N. Y. In this patent the invention refers especially to a car-seat of that class in which the back is made to shift from one position to another, so as to reverse the seat, and in which the seat proper is made to change its inclination in correspondence to the change in the position of the back. It resides in a certain novel manner of mounting the back or the back and seat to attain these results and in a peculiar arrangement of the foot-rest with respect to the mounting devices.

RAIL-JOINT.—C. J. SHEA, Freeport, N. Y. Mr. Shea's invention is an improvement in that class of rail-joints in which bolts, nuts, and fish-plates are dispensed with, the meeting ends of the rails being provided with interlocking tongues or projections. He has devised a construction and arrangement of parts whereby rail ends are so engaged as to be more firmly supported vertically and also held in more rigid alinement laterally.

RAILROAD-SWITCH.—L. L. LAKE, Fontanet, Ind. This invention is designed to dispense with frogs as ordinarily used. It provides a special construction of switch which leaves the main track smooth and unbroken when the main line is open and in which the switch-rail is raised slightly above the main track where it crosses the rails of the main track and has an adjustable crossover-section which in one position leaves the main rails open and continuous and in another position laps over one of the main rails and carries the wheels of the cars over the main rail onto the siding or diverging track.

RAIL-JOINT.—J. W. ENRIGHT and E. J. ENRIGHT, New Orleans, La. In this instance the improvement has reference to railway construction, and concerns itself especially with rail-joints. The object of the invention is to produce a rail-joint of simple form which will operate without necessitating the use of bolts and nuts to hold the abutting ends of two rails firmly together.

RAILWAY-RAIL JOINT.—H. C. BREWSTER, C. A. DUTHERAGE, and W. L. GLIDDEN, Shreveport, La. In this patent the invention is an improved means for connecting and supporting the meeting ends of railway-rails. It is more particularly an improvement in forms of truss connections and braces in which slidable wedges are employed to enable the parts to be readily tightened in order to preserve a rigid or unyielding support for the rails.

LOCOMOTIVE FIRE-BOX.—J. NILSSON, Fremont, Neb. The object of this invention is to so construct the fire-box and connected parts of a locomotive as to enable the contents to be dumped at will from the cab. To this end he employs in connection with the dumping ash-pan an operating device for the grate and ash-pan, such device passing into the locomotive-cab, so as to be readily operated by the engine-driver or his assistant.

CAR-COUPLING.—S. E. JACKMAN, New York, N. Y. This improvement relates to cars traveling on inclined or switchback railways, such as are used in places of amusement, and the object is the provision of a coupler arranged to safely couple adjacent cars to allow the cars to readily travel over sharp curves and steep inclines of the track without danger of the cars becoming uncoupled or jumping the track.

Pertaining to Recreation.

ADJUSTABLE LEG FOR BILLIARD-TABLES.—C. D. SEYMOUR, Rensselaer, N. Y. The purpose in this improvement is to provide simple and readily-operated means for raising and lowering the legs of billiard-tables or like articles of furniture for the purpose of leveling the bed or top of the article, it being possible to expeditiously and conveniently bring about such adjustment with little exertion.

TOY PISTOL.—L. H. HINAMAN, Port Jervis, N. Y. In operation the handle is drawn backward, pulling the plunger to the rear against the resistance of the rubber band, and the recess in the curved arm engaging the pivot-bolt retains the hammer in elevated position and the plunger at the rear of the barrel. The projectile being dropped in the open end of the barrel and the cap placed in the cap-seat, a pull on the trigger will elevate curved arm and release hammer and explode cap. The plunger is drawn forcibly forward projecting a marble with considerable force.

VELOCIPEDE.—F. M. THOMPSON, East Liverpool, Ohio. The object of the present invention is to provide for excluding the connections between the front and rear legs from view and for supporting the front of the sulky in such manner as to relieve the strain of such support from the imitation figure of the horse and to provide for a spring connection between the upper and lower leg-sections and for an adjustable seat for the sulky. It relates especially to that class of such devices which is represented in a former patent granted to Mr. Thompson.

GAME APPARATUS.—H. E. HENWOOD, New York, N. Y. Mr. Henwood's invention pertains to game apparatus, and more particularly to those in which various chance combinations in cards, dice, or the like may be secured by means of appropriate operating and controlling mechanism. His principal objects are to provide a convenient and effective apparatus of this character for agreeable diversion.

Pertaining to Vehicles.

VEHICLE FOR EXHIBITING GOODS.—E. LEFÈVRE, Berlin, Germany. The interior space of this vehicle is divided by means of partitions in such a way that spaces or compartments are formed which are visible from outside. These compartments are intended to be utilized as show-windows and to be dressed with exhibits. The vehicle may also serve for transportation of goods and other purposes. The arrangement can be provided in vehicles of all sorts, even hand-vehicles, and is in no way confined to vehicles drawn by animals or operated by mechanical power.

DEVICE FOR PREVENTING ACCIDENTS.—C. MATHEWS, Coalmont, Ind. The principal objects in this invention are to provide means for readily and quickly detaching draft-animals from a vehicle and for simultaneously applying a brake to stop the vehicle if it is going at a high rate of speed, and at the same time to provide means for effectually guiding the vehicle after the horse is detached.

VEHICLE-WHEEL.—M. G. BABIO, New York, N. Y. In this instance the invention relates to an improvement in vehicle-wheels, particularly wheels for automobiles and like vehicles; and the purpose of the construction is the provision of a wheel in which dishing strain is avoided and in which all necessary eccentric vibrations may take place at the center of the hub-section of the wheel when the wheel is in action.

VEHICLE.—J. J. FURCHTBAR, Joetta, Ill. The aim of the inventor is to provide a vehicle arranged to permit easy traveling, especially over rough surfaces, and capable of being used as a sled, skate, and the like. The device is very simple and durable in construction and allows the carrying of heavy loads with comparatively little power or exertion on the part of the person drawing the device forward.

AUTOMATIC WAGON-BRAKE.—E. F. VEATCH, Palco, Kan. This improvement in operation is entirely automatic. The brake may be easily applied to an ordinary wagon and may be used with or without a bed, being equally efficient in both cases. It is simple in construction, and is not liable to get out of order. Since considerable strain is brought to bear upon no part, the danger of breakage is reduced to a minimum.

THILL-COUPLING. — C. VIVES-NAVARRO, Ponce, Porto Rico. The principal objects of the invention are to provide means whereby the exertion of the pull upon the thills or tongue will be yieldingly resisted, so that the sudden starting up of the draft-animal will not cause a sudden jolt of the vehicle and so as to relieve the animal and vehicle from sudden strains of all kinds; also to provide similar means for causing the same kind of a resistance when the animal backs or the vehicle is pushed toward it.

VEHICLE-BRAKE.—D. GRUBB, Pike County, Ind. Mr. Grubb's invention is an improvement particularly in that class of brakes in which the brake is automatically set by the holding back of the team in descending an incline. The means for use in setting brakes by hand is an important feature, as when desired the handle-lever may be fitted at its socketed end on an upwardly-projecting arm, the handle-lever being secured in any desired adjustment by a rack. This handle-lever may also be utilized to lock the brakes free of the wheels.

Designs.

DESIGN FOR A SANDWICH-SIGN.—J. J. MEYER, New York, N. Y. This ornamental sign comprises a design representing a sausage partly covered by a roll or cheese sandwich placed on a flat broad surface. The top end of the frankfurter is pierced with three oblong holes. The sign carrier looks through the upper apertures and the whole is supported by shoulder hangers and waist band.

DESIGN FOR AN ASH-TRAY.—A. Q. WALSH, New York, N. Y. This new, original, and ornamental design represents an ash-tray of circular form. Upward continuation of the well-rounded sides at the front constitute a partial hood, the rest and greater part remaining open. The tray shows considerable depth, its bottom is flat, and a very graceful downward-curved handle is riveted at the back end of the tray.

DESIGN FOR A BRACELET.—C. S. HURD, Newark, N. J. In this case the design is for a bracelet exteriorly ornamented with leaves and flowers on a mottled background. Six slightly prominent scroll-worked shields are placed at regular intervals around this beautiful article.

DESIGN FOR A FINGER-RING.—J. L. HERZOG, New York, N. Y. In this ornamental and unique design the top of the ring is set to hold two dog heads, one on each side of the setting. The heads are in alinement, back to back, and slightly separated by a deep depression in the setting. The paws on which the heads rest hang over the curve of the ring.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**
MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 7703.—For parties who can manufacture heavy ditching machinery, and to undertake the manufacture of a tested and novel machine.

For bridge erecting engines. J. S. Mundy, Newark, N. J.

Inquiry No. 7704.—Wanted, addresses of manufacturers of candle-making machinery.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 7705.—Wanted, manufacturers of hydraulic presses.

Drying Machinery and Presses. Biles, Louisville, Ky.

Inquiry No. 7706.—Wanted, makers of cross-arm pins for telephone and telegraph use.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 7707.—For makers of brick and hollow concrete block machinery.

WANTED.—Purchaser for Monazite, Molybdenite and Wolfram. Apply Monasite, Box 773, New York.

Inquiry No. 7708.—For makers of shoe cobbler tools.

FOR SALE CHEAP.—Steam power shop nearly new, in sleepy, isolated village. H. Sage, Waterbury, Conn.

Inquiry No. 7709.—For makers and installers of ice plants.

I sell patents. To buy, or having one to sell, write Chas. A. Scott, 719 Mutual Life Building, Buffalo, N. Y.

Inquiry No. 7710.—For makers of hand power and horse power machinery for sawing wood.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company, Foot of East 138th Street, New York.

Inquiry No. 7711.—For makers of milking apparatus.

WANTED.—Ideas regarding patentable device for water well paste or mucilage bottle. Address Adhesive, P. O. Box 773, New York.

Inquiry No. 7712.—Wanted, a feather renovator.

I have for sale the U. S. and all foreign rights of new patent Improvements in Water Tube Types of Boilers. Great economizer. J. M. Colman, Everett, Wash.

Inquiry No. 7713.—For makers of soundboards (reedboards) for organs.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery tools and wood fibre products. Quadriga Manufacturing Company, 18 South Canal St., Chicago.

Inquiry No. 7714.—For makers of plan and ball-bearing casters and malleable iron wheels and axles of all sizes.

FOR SALE.—Patent for absolutely non-refillable bottle. Simple in construction, perfect in operation. Will cost only a trifle more than regular whisky bottles. Apply to James Clausen, 2525 Rauschenbach Ave., St. Louis, Mo. Patented Dec. 12, 1905, No. 806,917.

Inquiry No. 7715.—Wanted, makers of Venetian iron work and accessories.

PATENTS.—Wanted, the service of a patent expert and experienced specification writer. No one need apply who has not had a thorough education along technical lines, and who has not had experience in patent practice. Munn & Co., 361 Broadway, New York.

Inquiry No. 7716.—For manufacturers of pumps or ditchers that can be run by 6½ h. p. engine.

NOTICE.

To the Inventor Members of the American Manufacturing Co., 113 Adams St., Chicago., Ill. As I have information that would be of interest to inventor members of the American Manufacturing Co., I would like to enter into communication with said inventor members, not holding office, with the sole object of placing them in charge of information which will materially protect their interests. Inclose stamp when writing. Fred L. Wakefield, Chester, Vermont, an ex-stockholder.

Inquiry No. 7717.—For manufacturers of glazing glass for glazing leather.

WANTED.—High-class machinists and tool makers. Good wages. No labor troubles.
Driggs-Seabury Ordnance Corporation, Sharon, Pa.

Inquiry No. 7718.—For manufacturers of steam bread-baking machinery.

Inquiry No. 7719.—For manufacturers of brick-making machinery.

Inquiry No. 7720.—For manufacturers of machinery for making excelsior.

Inquiry No. 7721.—For manufacturers of knitting machinery.

Inquiry No. 7722.—Wanted, address of party willing to manufacture and place on market, on a royalty basis, a new flying toy.

Inquiry No. 7723.—For manufacturers of mills or instruments for pulverizing lime or marble into impalpable powder.

Inquiry No. 7724.—For manufacturers of extremely fine sieves for impalpable powder.

Inquiry No. 7725.—For manufacturers of instruments for amusing people.

Inquiry No. 7726.—Wanted, address of party manufacturing telephone receiver cushions.

Inquiry No. 7727.—For manufacturers of confetti making machines.

Inquiry No. 7728.—For manufacturers of shaving machines for men.

Inquiry No. 7729.—For manufacturers of watchman's detector.

Inquiry No. 7730.—Wanted, address of parties manufacturing matches.

Inquiry No. 7731.—For manufacturers of solid rubber balls, from 1 to 3 inches in diameter.

Inquiry No. 7732.—For manufacturers of lifting and conveying apparatus for conveying different size boxes, barrels, etc., up and down and horizontally.

Inquiry No. 7733.—For manufacturers of hand-driven printing presses with accessories.

Inquiry No. 7734.—Wanted, address of parties dealing in Smith & Stokes automatic paper box machines.

Inquiry No. 7735.—For manufacturers of merry-go-rounds.

Inquiry No. 7736.—For manufacturers of small toy engines castings in brass and iron.

Inquiry No. 7737.—For manufacturers of small acorn-shaped watch protectors.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(9870) H. J. B. asks: 1. I wish to learn why, in building the A. C. dynamo described in SUPPLEMENT 1558, the fields are wound on brass tubes. When in a medical coil we wish to cut out the magnetism of the core we slip a brass tube over the core, which takes up the lines of force and keeps them bound down within the tube. If the brass tube has such an effect in one place, why not in the other? A. Your idea that brass can stop magnetic lines of force is erroneous. There is no known insulator for magnetism. Iron and steel furnish an easier path for magnetic lines than any other substance. Hence if we wish to protect a magnet from external magnetism, we cover it with a box of iron. Other substances, such as brass, allow lines of force to pass with about the same difficulty as does air. Hence brass may be used as a spool for the field coils of a dynamo with no harm, especially when, as in this case, a strong spool is required. In the case of the medical coil, to which you refer, the action of the brass tube is not to screen or cut off magnetic lines of force at all. The interrupted current in the primary coil acts upon the brass or copper, or any other metal, in the tube which is slipped over the primary coil to produce in the tube currents of electricity, which are in the opposite direction to the primary current, and which for that reason cut down the magnetizing power of the primary upon the secondary. With the tube over the primary there is less current in the secondary; when the brass tube is drawn out the secondary current increases, but not because magnetic lines of force are cut off by brass. Eddy currents, opposing the primary, are produced when the tube is pushed over the primary, and cut down when the tube is withdrawn. There is not one effect in one place and an opposite effect from the same cause in another. The action in the two places is entirely different. If a continuous current flowed in the primary of a medical coil without interruption, there would be no eddy currents in the brass tube and no induced currents in the secondary. This is the way the current flows in the field magnets of the dynamo. The interruption of the primary current in the medical coil causes the eddy currents in the brass tube and the currents in the secondary coil. 2. If the armature should be wound with much finer wire, what would the effect be? A. A finer wire on the armature of the small alternator would cut down the amperes but leave the volts the same, if the same number of turns were put on; if more turns were put on the volts would be increased, and the amperes reduced more than in the first case. 3. Wherein does this alternating current differ from that generated by the glass plate machine or the induction coil? The dynamo described in SUPPLEMENT 1558 is said to give the same effect as the current from an ordinary medical coil, but the wire is much coarser. Does the field winding on the dynamo represent the primary of the coil? A. An alternating current is one in which the electromotive force rises from zero to its highest value, then falls through zero to a value as far below zero as it was previously above zero, rising again to zero. This series of changes constitutes a cycle. Cycles are repeated from 30 to 130 times a second in the various forms of alternating current. Neither the plate electric machine nor the induction coil as ordinarily employed acts in any such manner. Both of these have their electromotive force raised till a spark jumps across between the poles. The same action takes place repeatedly. The current is pulsating and not alternating. An alternating current will, however, produce spasmodic contractions of the muscles, just as a coil does. The field winding does not represent the primary of a coil. It furnishes a steady flux of lines of force through an armature. The armature revolving through this flux produces an electromotive force which is the cause of a current over the external circuit, doing its required work there.

(9871) A. B. D. asks: Please tell in the Notes and Queries column of the SCIENTIFIC AMERICAN, or otherwise, how to ascertain the candle-power of an arc lamp. Also how to make a small searchlight. A. It is not easy to measure the candle-power of an arc lamp, since it gives a varying amount of light in different directions. The mean spherical candle-power is the rated candle-power. This is the

mean of all measurements above and below the horizontal, and is the true average candle-power. It is the most difficult to obtain. The "nominal candle-power" is the one oftenest spoken of commercially. It is a value arbitarily taken to correspond to a certain consumption of energy in the arc. Thus an arc taking 450 watts is called a 2,000-candle-power lamp, and 300 watts are assumed to give 1,200 candles. These numbers are perhaps near the maximum candle-power of an open arc lamp. A small searchlight may be simply an arc light so arranged that it can be swung to throw its light strongly in different directions by attaching to it a parabolic reflector. Such a one as is used on a locomotive headlight would be good for the purpose. SUPPLEMENT No. 1276 contains a description of a portable projector which may be useful in making a searchlight. We send it for ten cents.

(9872) F. K. W. asks: Will you please write to me telling me the dimensions for a smoke box for making rings? I wish to use it simply for experimenting. What substance should be put over the end to be knocked? What size hole? A. A box for making smoke rings may be of almost any size. One which we have used with success in our lectures for a good many years is about 18 inches long and 8 inches square, with a hole about 4 inches in diameter in one end. A sheet of pure rubber is fastened over the other end with cleats. The advantage of a box of some size is that it contains a large volume of air with which to form rings.

(9873) P. writes: Regarding Answer 9840, I would say J. F. overlooks the essential point in the question, namely, the ability of a moving body to overcome resistance to its motion. The two balls of equal size present equal surfaces to the air and experience equal resistance from the air so long as their velocities are the same. But there seems to be a failure to see that the resistance of the air is a constant resistance which the ball must overcome in the same manner that a moving car must overcome the friction of the brake applied to its wheels. The falling ball must displace air, and the displacement of the air is a variable resistance dependent upon the velocity of the moving body. The ability of the falling ball to displace air depends upon the weight of the falling ball, since it is momentum which pushes the air aside, and this varies both with the weight and the velocity of the ball. The lighter ball cannot push air out of its path as easily as the heavier ball. It will soon find itself left behind in the race, and the heavier ball will reach the ground first, since the retardation increases as the time of fall increases. It may be accepted as good authority to quote Wood's "Elementary Mechanics," page 33, sec. 71: "The attraction of the earth being the same on each particle of a body, a light body would fall as rapidly as a heavy one if there were no resistance to their movements; and this is confirmed by experiment, by letting bodies fall in a vacuum. The resistance of the air varies with the surface against which it acts, but in falling bodies the ability to overcome this resistance varies as the weight of the body; hence, heavy bodies fall faster than light ones in the air. But the velocity of heavy bodies, such as iron, stone, brass, etc., falling from 100 to 200 feet, do not differ much from each other." If bodies fell as J. F. reasons they should, rain drops would hit our devoted heads with the velocity of shot falling from the same height, often a mile, and would, as shot would, give us a smart blow, to say no more.

(9874) P. C. D. asks: Will you please explain the cause of the light line around dark objects seen against the bright sky, also around shadows cast by an arc light? It occurs occasionally in photographs, especially those taken at sunset. A. The bright border sometimes seen around a dark object against a bright surface is due to the sharp contrast of the object and its background, which also causes the dark object to seem smaller than it actually is. The light line seen around a dark object in a photograph seems to be due to another cause. It appears that the gelatine film is thicker in one part than in another after it is dried. The place where the film curves from the thick to the thin part acts as a lens to diffuse the light and make a narrow band where the print is thinner and so brighter than elsewhere.

(9875) C. A. R. asks: 1. It is a known fact that weakening the field of an electric motor decreases its speed, and yet it would stop if the field current was opened. Now, at what point does weakening the field cease to decrease its speed? Make as clear as possible. A. If the armature current for a motor is supplied at a constant voltage, strengthening the field has the effect of decreasing the speed, and weakening the field increases the speed of the motor, for equal power. This is due to the counter electromotive force generated by the armature of the motor by its rotation. It makes no difference whether an armature is driven by electricity or by some other power, an E. M. F. is generated by it in the opposite direction to that of the same machine as a motor. The current flowing in a motor is weaker the faster the motor runs. This is well explained by Thompson in his "Elementary Lessons," under motors. We send the book for $1.50. 2. Many people think it is a strange wonder that electricity is used to such an extent and yet no one knows what it is. I sometimes tell them that its "being" is not much more wonderful to scientists than that of heat, light, gravitation, and many other things. To what extent do I answer right? A. While it must be admitted that all is not yet known regarding the nature of electricity it is certain that much more is known that was known even a few years ago. Such a book as Whewell's "Recent Advances," or Thompson's "Electricity and Matter," will give a fair presentation of the subject. We furnish the first-named book for $2, and the second for $1.25. 3. How is the speed of gasoline engines regulated and governed when automatic? A. The speed of a gasoline engine is regulated in one of several ways—by throttling the supply of gas mixture, by stopping the feed of gasoline for several revolutions, by manipulation of the exhaust valve, or, with electric ignition, by cutting off the spark. These changes may be operated by a ball governor or any other device. 4. I have been studying on a device to give warning signal by either light, or bell, or both, at the approach of street cars on crossings. Each (in) line would have a separate device of its own at a certain place to indicate when the car is coming. Is any such thing in use anywhere; if not, why not? A. Any novel device you may invent for signaling the approach of a car to a crossing can be patented, and might be sold to railway people. 5. What can you say for the device by which it is claimed a person when telephoning can see the one talked to? A. We cannot say anything about a device for seeing a person to whom one is talking by the telephone and who is at the other end of a line. We have never seen such a device.

NEW BOOKS, ETC.

A TREATISE ON CONCRETE, PLAIN AND REINFORCED. By Frederick W. Taylor, M.E., and Sanford E. Thompson, S.B. New York: John Wiley & Sons, 1905. 8vo.; pp. 585. 176 figures. Price, $5.

The present treatise, which is a most complete one, is designed for practising engineers and constructors, and also for a text and reference book on concrete for engineering students. The entire subject of concrete and the process of concreting is described, including classification and use of cementing standard and special tests for cement, strength and composition of cement, mortars, reinforced concrete, mixing concrete, depositing concrete, effect of sea water on concrete and water, fire and rust protection, sidewalks and basement floors, building construction, foundations and piers, dams and retaining walls, arches, tunnels and conduits, reservoirs and tanks and cement manufacture are all adequately treated. There is little question that this book will be of very great value at the present time, when there is such an interest in the subject of the utilization of concrete.

GRAPHIC METHODS OF ENGINE DESIGN. By Arthur H. Barker, B.A., B.Sc. London: Technical Publishing Company, Ltd., 1905. 12mo.; pp. 210. 90 diagrams. Price, $1.50.

The author had a two-fold object in view in writing this book, which is now in its second edition. In the first place, he attempted to describe and explain clearly a series of easy and practical constructions for use in the drawing office by young mechanics aspiring to positions in such offices, and having little idea of the sort of mathematical knowledge required in designing engines on correct principles. The author's second object is to show the intimate relations necessarily existing between the science of engineering and exact principles of what is called "theoretical" mechanics. The mechanism of the steam engine forms a very complete series of illustrations of these principles, and the book is intended to make clear their application to practical work. Examples of almost every principle found in books on elementary dynamics are contained in it, and all principles are treated numerically, besides being also fully described. The author has devoted a considerable portion of his work to the subject of balancing, and this subject will be found discussed in a very interesting and easily-understood manner by all who read the work.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending January 9, 1906.

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Accounting appliance, credit, P. A. McCaskey 809,723
Acid, etc., making boric, H. Blumenberg, Jr. 809,550
Acids, making dialkyl-barbituric, M. Engelmann 809,362
Adhesive and making same, F. H. Patch 809,739
Adjustable bracket, S. Kahn 809,448
Air brake, anchor emergency, C. Z. Sanders 809,632
Air heating system, F. S. Lamson 809,306
Ammunition hoisting mechanism, Meigs & Stout 809,455
Amusement apparatus, E. S. Timmons 809,589
Anchor, earth, E. C. & H. Holden 809,374
Anchor post, R. Wiltse 809,879
Anthracene compound and making same, Bally & Wolff 809,893, 809,894
Antiseptic compounds, making solidified, D. Genese 809,795
Antitoxin for fatigue and making the same, W. Weichardt 809,347
Asymmetric cell, M. Buttner 809,770
Auger bit, J. Stein 809,856
Automobile body, A. R. & F. S. Welch 809,655
Automobile dust allayer, W. H. Parker 809,738
Automobile frame, A. R. & F. S. Welch 809,656
Automobile race course, Thomas & Lynch 809,588
Axle box, railway car, H. Stuting 809,404
Axle truss, C. M. Haeske 809,297
Bag fastener, E. G. Staude 809,756
Bales, machine for forming round cotton, C. M. Cagle 809,283
Baling press, J. W. Reynolds 809,844
Baling press, J. Unfried 809,867
Barrel head, removable, A. Jaeger 809,918
Barrel opener, Knight & Russ 809,380
Basement and the like ventilator, P. H. Jackson 809,617
Basket, clothes pin, S. W. Hurlburt 809,568
Batteries, machine for filling dry, P. P. Nungesser 809,526
Battery plate, storage, D. P. Perry 809,742
Bearing, vertical shaft, E. W. Broomall 809,280
Bed and cabinet, folding, N. Lui 809,710
Bed corner fastening, B. H. Jones 809,447
Bed, sofa, G. N. Wersel 809,657
Bedstead attachment, W. A. Wright 809,352
Bell push, pull, etc., L. S. Wilks 809,595
Belt shifter, Seyboth & Baumann 809,329
Billiard and pool tables, cigar holder for, E. E. Hanks 809,441
Binder, F. A. Cleveland ..... 809,426, 809,493 to 809,496
Binder attachment, A. Williams 809,877
Binder, loose leaf, E. G. Dumas 809,557
Binder, loose leaf, L. Sussman 809,587
Bismuth disalicylate and making same, B. R. Seifert 809,583
Bleaching fibers, J. Wakefield 809,869
Blind slat fastener, window, M. J. Coogan 809,779
Block molding machine, H. P. Gates 809,367
Bobbin holder, T. J. Murdock 809,624
Bolster, A. E. Ostrander 809,736
Bolt clipper, J. Pulvitt 809,843
Book support, J. Maccallum 809,315
Bookbinder's gage, A. Von Auw 809,411
Bottle closure, J. C. Condo 809,427
Bottle corking machine, Schlosser & Fisher 809,850
Bottle filling machine, F. B. Thatcher 809,407
Bottle, non-refillable, Dolan & Shoemaker 809,289
Bottle washing machine, Loew & Miller 809,514
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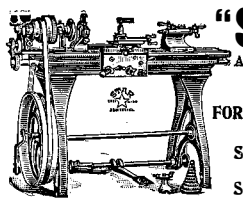

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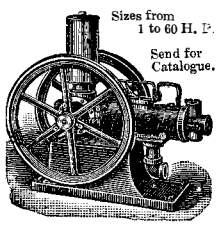

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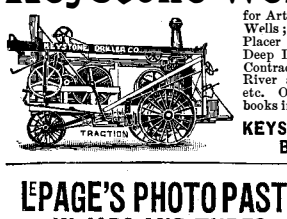

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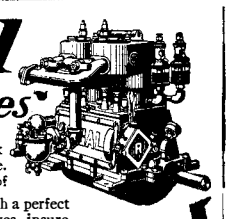

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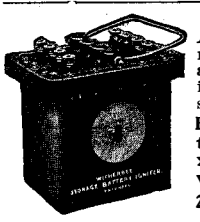

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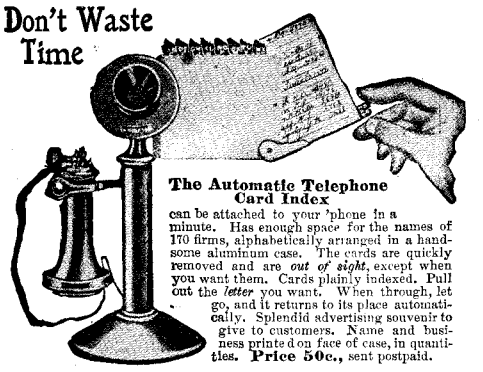

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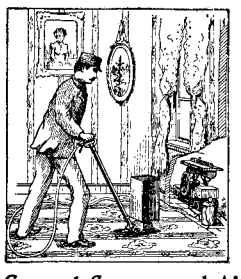

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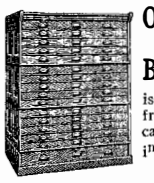

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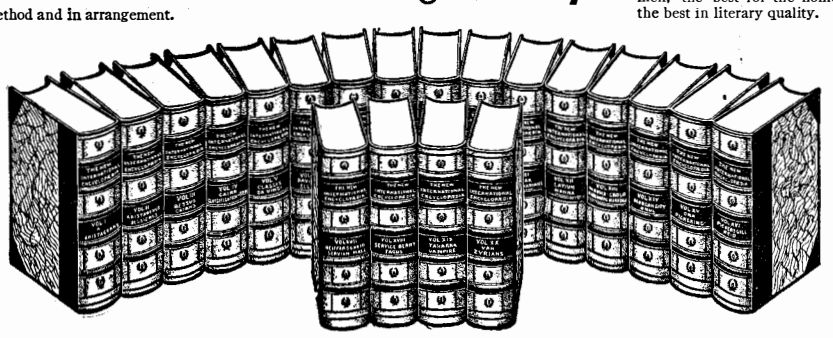

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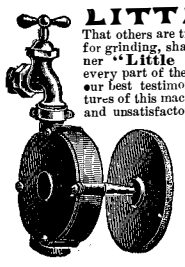

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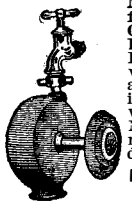

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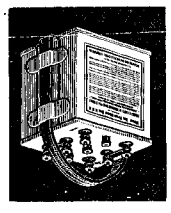

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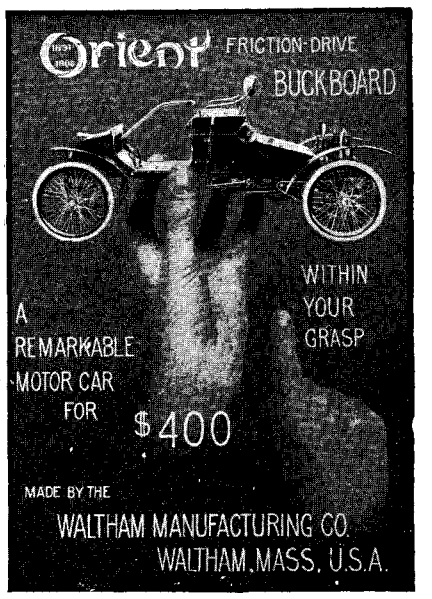

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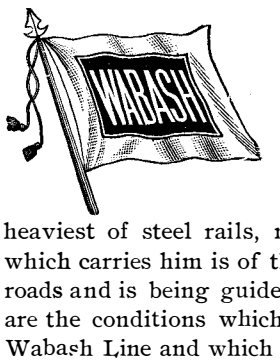

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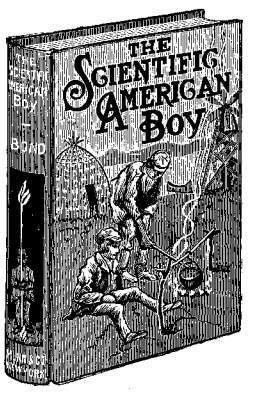

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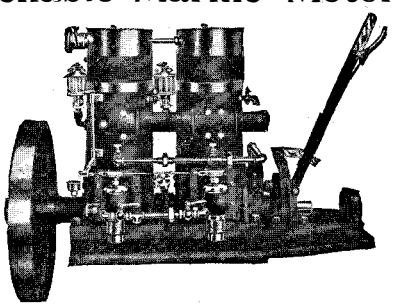

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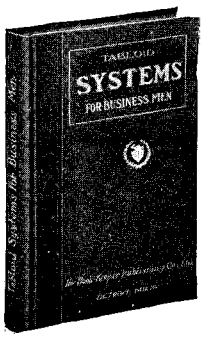

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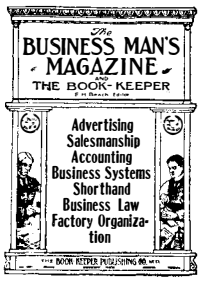

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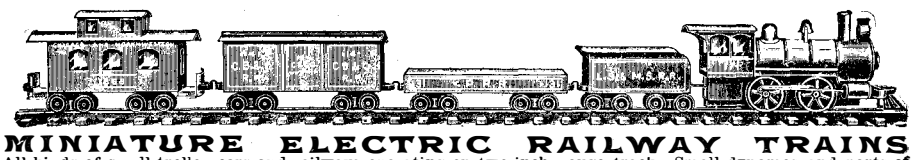

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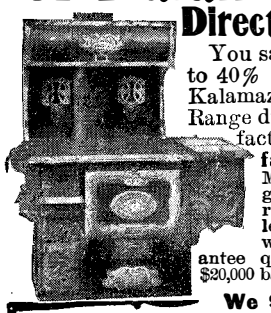

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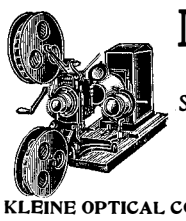

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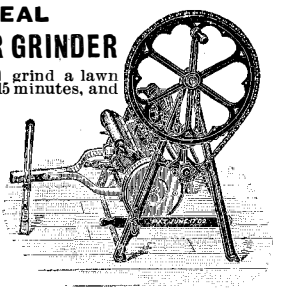

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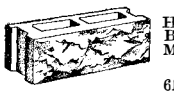

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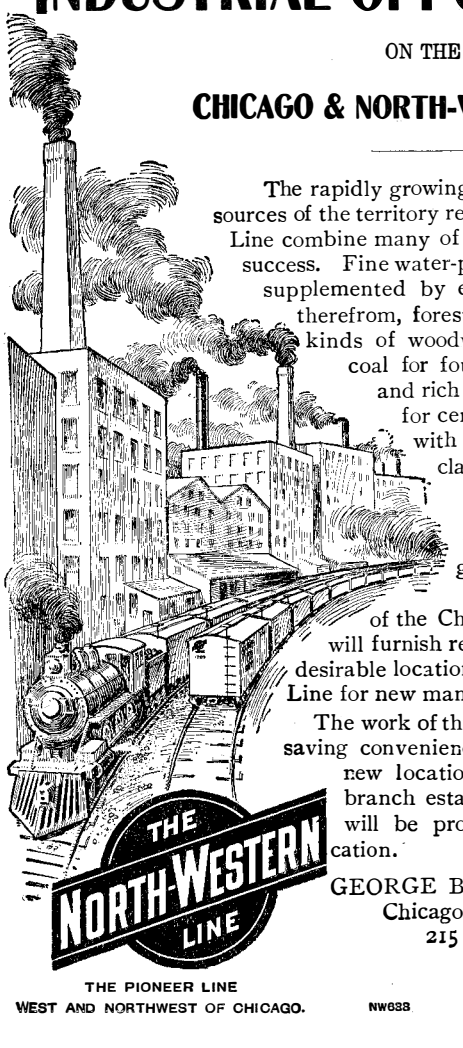

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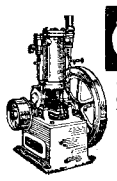

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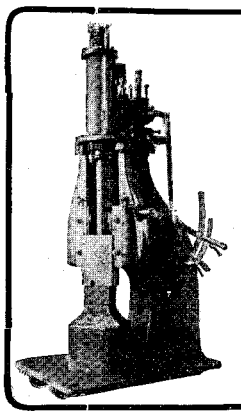

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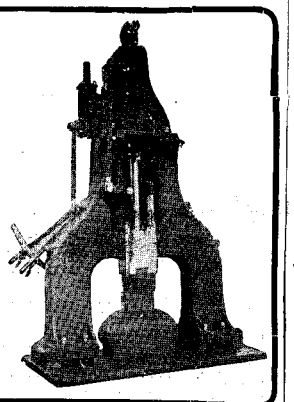

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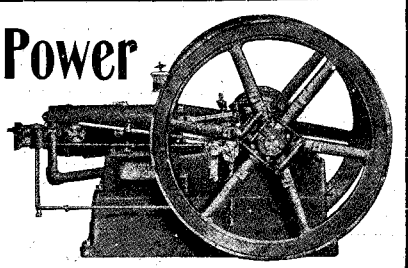

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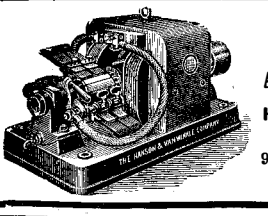

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